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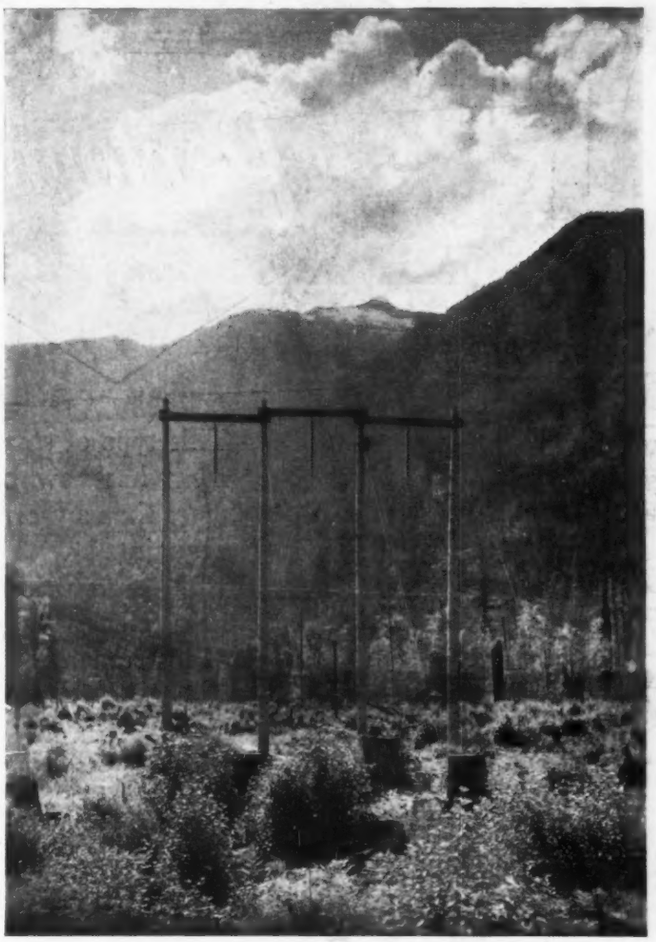

Wooden poles are used on the 165,000-volt, 100-mile line which will bring power from the Skagit River to Seattle.

See page 973.

The Inter-Scandinavian Superpower Project

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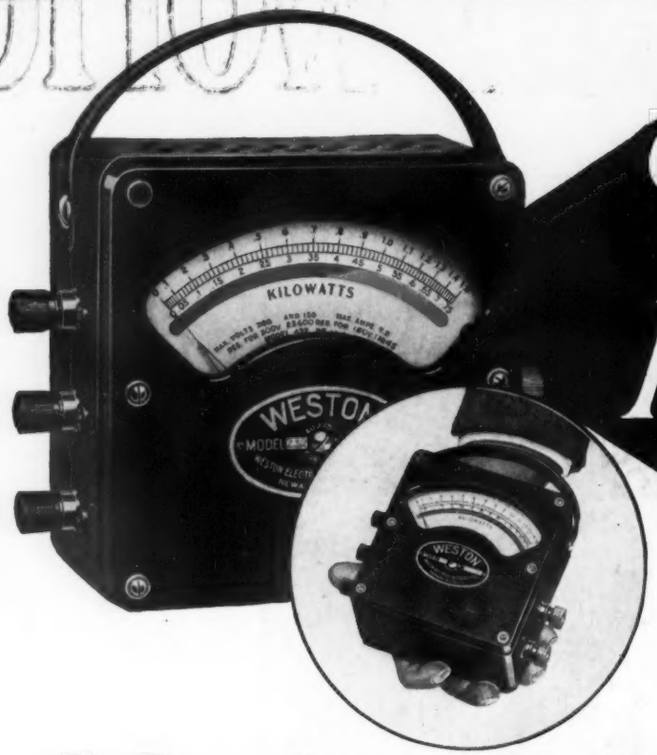

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W. H. ONKEN, JR. Editor — HAROLD V. BOZELL Editor

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Making a Smoke Screen of Superpower

SUPERPOWER in the public mind is the monkey gland that will invigorate the country mechanically by making electricity available in such abundance and at such a price that even "father" won't have to work any more. Like radio in its heyday, superpower appeals to the imagination of the public, and countless enthusiasts have begun to preach the popular gospel and lead their converts to dazzling heights in the clouds of fantasy.

When the great day of superpower comes, it is made to appear, the turning of a switch will force electrical genii to serve all human needs. They will fructify the soil, waft men and materials hither and yon, turn darkness into light, metamorphose toil into silken repose, change hovels to palaces and, in fact, flagellate Elysium into existence with St. Elmo's fire.

THE flatulence and looseness of newspaper treatments of superpower should excite neither surprise nor resentment in the minds of electrical men. It is but natural that they should be attracted principally to the dramatic aspects of this new phase of the ever-fascinating subject of electricity, and that they should be writing largely in ignorance of the very technical considerations which underlie every advance in engineering and invention.

The interpretations of self-seeking politicians but add fuel to the flames of popular credulity and emit smoke screens behind which naked selfishness can work. Good and bad, conceptions and misconceptions, true and false — all are inextricably associated in popular fancy, and this condition may bode good or ill for superpower.

Initiated as an essential act of evolution by the electrical industry, promising a great expansion to the public service, superpower must not be permitted to become a boomerang. The very term "superpower" is perhaps misleading and unfortunate. It suggests superintensity rather than a great massing of power resources through the interconnection of existing systems supported by the development of new ones. This must all be made clear to industry, to the press and to the public.

IT IS a responsibility upon all electrical men. Armed with truth and inspired by understanding, the men of the industry can bring the real superpower past all pitfalls and properly enthrone a national electricity supply as the greatest source of national prosperity and human well being. But no passive policy can be expected to prevail. If superpower is to be appreciated by the people and adequately protected against the perverted purposes of politicians, those who have the practical conception of superpower and its worth must preach the true gospel. It would be no less than a national calamity if superpower through misrepresentation were to be misjudged and condemned to obstruction and delay.

George N. Tidd

An executive who combines an unusually thorough knowledge and appreciation of the engineering, economic and human problems involved in the generation, transmission and utilization of electric power.

IN THIS age of specialization there is still given to some men the happy faculty of obtaining a full view of an entire field and mastering every section of it. The field of electric public utility management and operation has such a man in George N. Tidd, president of the American Gas & Electric Company.

Born in 1874, Mr. Tidd early entered the electric power industry, filling positions in various capacities and obtaining at the same time a complete grasp of every phase of the work. Managing successfully at first one of the smaller and then one of the larger properties, Mr. Tidd, through his progressiveness and his ability to inspire those working under him with his zeal, made himself so felt throughout the then young and relatively weak American Gas & Electric Company's organization that by 1909 he was called to be its active operating executive, being made vice-president and general manager.

Firmly convinced that the foundation of successful electric central-station management is an economical generating unit, Mr. Tidd on assuming the general managership began and carried out the construction of a series of modern and efficient steam-turbine plants. Around these as nuclei the American Gas & Electric Company system was built. In the process of building he developed or caused to be developed and utilized many of today's accepted schemes and principles of sound operation, often being the first to do so. Among these are high steam pressures, the mouth-of-mine base-load plant, high voltage as a primary with half of that value as a secondary transmission voltage, and high-voltage outdoor substations and extensive interconnection between plants of the system or with other systems where economies could be gained thereby. That he planned and built well is attested by the fact that from an almost insignificant group the company, under his guidance, has become one of the leading public utility holding companies, supplying electrical energy to 328 towns and cities in New Jersey, Pennsylvania, Illinois, Michigan, Indiana, Ohio, Kentucky and West Virginia. Further, the properties in the last five states are not isolated but have been or are in the process of being connected into a sectional super-power system.

In this development of the system and of the man the human side of the relationship between him and the men employed by him has at no time been subordinated. He himself having risen from the ranks, Mr. Tidd has always insisted that the men with the organization shall have the opportunity of growing with it.

Editorial Comment

Electrical World, November 10, 1923

Volume 82 Number 19

The Job of the Utility Manager

OFTENTIMES operating engineers wonder what a manager of a public utility property does besides issuing orders. To many of them the manager appears to have a sinecure. Public relations work seems an easy and simple thing to those who have never dealt with it seriously, and as for financing, all that the novice feels the manager does is to get in touch with "Wall Street" and the problem is solved. Of course, those who have tried to raise money know how hard it is to get people to part with it even for gilt-edged securities, and many a man in the public utility business sees no connection between finance and rates. It is there, nevertheless, and a careful manager may save the community more at times than his operating engineer. For example, the American Telephone & Telegraph Company has just issued $100,000,000 of twenty-year sinking fund 5½ per cent gold debenture bonds, with which to retire $90,000,000 of short-term 6 per cent notes. By this one transaction the company effects a saving of $450,000 annually in interest charges alone, besides providing funds for additions and betterments. Wouldn't an operating engineer have some difficulty to make such a saving with his present equipment? And yet financing is only one of the jobs that fall to the lot of a public utility manager.

The Electrical Industry's Place in the Chorus

SOMEWHERE between the two extremes of Brewster with a million to spend in a year and the poor widow who does housecleaning to support a family there are thousands of homes where the annual income necessitates a tax return. There are well over seven million families in the United States reporting an income in excess of $2,000. These are families that live in electrically wired homes, drive automobiles, enjoy piano and victrola music and live, not in terms of necessities only, but in terms of necessities plus convenience plus pleasure. They are receptive to the good things of life.

There has been competition for the business of these families. They constitute the market not alone for electric service and electrical household appliances, but also for kitchen cabinets, New England codfish, correspondence courses, saxophones and Persian rugs. The electrical industry, therefore, must sell its wares, and the electrical service idea which it is promoting, in keen competition with all the appeal of music in the home, convenience in the kitchen, comfort in the bedroom, enjoyment out of doors, better food, better equipment, better everything.

All these experienced competitors are persistently clamoring for attention and everlastingly keeping at it. They are telling their stories dramatically and appealingly, and that is one reason why phonographs, gas ranges and metal beds outsell clothes washers, electric ranges and ironing machines. They will continue to outsell electrical products until electrical men stop assuming that because they themselves understand the value of electrical equipment General and Mrs. Public must appreciate it also.

One of the great lessons of business which most utility men have still to learn is that their story cannot be told once or intermittently. The chorus of competing ideas ceaselessly intrudes its many voices. The electrical idea cannot hope to drown the others out. It is compelled to sing with them, and if it is to be heard it must sing well and loud and long.

A Real Impetus to the Advance of Engineering Education

THE announcement this week that the Carnegie Corporation has appropriated the sum of $108,000 to be devoted to an intensive study of engineering education must give concrete encouragement to those interested in substantial advance in that most important phase of engineering interest. The study is to be under the direction of the Society for the Promotion of Engineering Education, and the active work is to be conducted by a competent director whose appointment is thus authorized and made possible.

Engineering education has been discussed for many years. It has been diagnosed by many doctors. Engineering graduates have been analyzed and criticised. Industry has been accused of making unwise use of graduates or else of demanding too perfect a product. Industry has in turn accused the schools of not knowing the specifications that should govern the manufacture of its product.

The present investigation should do much not only to clarify the facts in the case to all concerned, but also to effect really constructive modifications in the practices of engineering education if they are needed. As pointed out in the correspondence leading up to the Carnegie Corporation's action: "The investigations of this society [will] be directed to a study of the objects of engineering education and the fitness of the present-day curriculum for preparing the student for his profession. It will study the process by which the curriculum of fifty years ago has come to its present form; it will seek to set forth the nature and the weakness of the curriculum as at present administered, and it will indicate such modifications or developments as would seem to make for a sound, well-balanced and fruitful course of study for engineering students." It is also proposed that a necessary part of the director's work shall be to make first-hand investigations of European engineering education to see what methods developed in Europe are applicable here.

It is definitely encouraging as pointing to tangible results that the Carnegie Corporation, known for its

integrity of purpose and adherence to concrete problems, should see opportunity in this program to perform a substantial piece of work. To Prof. C. F. Scott and to his co-committee workers, who with him have given definiteness to this program and have thus made possible a study the results of which will have far-reaching beneficial effect, engineers of all branches will be more than grateful. The work will be watched with interest and its results awaited with eagerness. But meanwhile, as the work progresses during the next three years, engineers should take every opportunity to co-operate in order to make the result of the study of greatest value to their profession and to industry.

Compartment Interlocks Subject of Debate

HOW to interlock bus compartments in such a manner as to remove hazards to operators in generating stations and substations has troubled engineers, but no company has yet proposed any generally accepted satisfactory solution. Despite the many schemes that are in use and the almost universal custom to use some form of interlock on all station compartments, no plan which has been put forth is conceded to present a complete solution.

Some companies use simply a wooden bar on each compartment group; others use signal lights, and others have automatic lever connections between compartment doors, oil breakers and disconnecting switches. A still later arrangement is based on the use of a lock which operates a switch in the closing circuit of the oil breaker; the key cannot be removed from the lock unless the breaker is opened and the breaker cannot be closed until the key is again placed in the lock.

But there is an objection to all of the schemes, and it is that they are not entirely foolproof. The shift operator and the assistants are human beings and their actions cannot always be predicted with complete confidence. There is a necessary division of labor and of responsibility that leaves the way open for human mistakes. Moreover, in some cases the very elaborateness and complexity of the interlock schemes increases the tendency for operators to take unsafe short cuts under emergency conditions or when the interlocking equipment gives trouble.

Nevertheless, each of the various schemes does give an added element of safety, and this is what is desired. Meanwhile experiences with present equipment and study of other possibilities will help develop a method which may be unanimously accepted as best for general adoption.

Strong Indorsement for Public Information Committees

DURING the recent convention of the American Electric Railway Association W. H. Sawyer, president of the East St. Louis & Suburban Railway, stood forth before his fellows and talked about the work of the public utility information bureaus and what it had been worth to him. It was the kind of a straightforward, manly talk that carries influence. For there is all the difference in the world between blandly accepting such an institution, such a service, as one more "good thing that ought to be supported" and being inspired by listening to an informed and capable executive tell what it is worth and why. "I am not going to criticise those executives who by their actions show that they believe their other work is more important than supporting the committee on public utility information," said Mr. Sawyer, "but I am going to tell them that in my opinion they are missing the best bet."

There are many instances of record where these information bureaus have proved their worth. Utilities need their services—and more of them too. But, even more than that, the individual utility needs to know a little more intimately what this benefit is that has been made available through these state organizations and how to take advantage of it—and how to help in the good work.

Mr. Sawyer put especial emphasis on the profit that comes to the utilities from co-operation with these information bureaus, even in the present stage of their organization and proficiency. A more adequate support from the operating companies, he said, will greatly strengthen and extend the bureaus' influence, and he called upon utility men to get behind this agency of education. The foundation of good public relations is facts—public knowledge of the functions and the record of the service company. These committees are telling this story of the central station for the hundreds of busy executives who cannot or do not tell it adequately themselves. Mr. Sawyer's appeal should not go unheeded by the central-station companies.

Service Transcends Rates

GOOD will for public utilities is made up of many items, but the greatest of these is service. Prices are of secondary importance. No manager can impose fantastic charges and escape popular censure, of course, but no intelligent executive attempts to do so. American standards of living put service before cost so long as the latter is within reason, and it is to the credit of the industry's leaders that they strive to maintain high standards of service in the face of every obstacle. The relatively small number of service complaints which reach the hearing stage in commission regulation of central stations affords a remarkable index of the quality of service rendered the public as a whole.

Once in a while a certain demoralization of service may get a start in a department or in a company. The causes may be obscure to the public, but they should not be hidden to the managerial eye. Personal rivalries sometimes attain headway; lost motion between departments develops; equipment fails unexpectedly, or there may be inefficient forecasting of load requirements. Prompt action by executives is vitally important in such cases, with rigorous analysis of all operating conditions and administrative methods. Larger appropriations for engineering may save the day in some cases; in others sweeping changes in routine may be essential. The causes are always determinable and should be sought out with the impartiality of the laboratory. It is the mark of a good executive to keep tangible and intangible factors bearing upon service under control, and this involves full co-operation by employees and continuously satisfactory public relations as a by-product. Good utility housekeeping, in a word, is what is needed to maintain the requisite standards.

An Executive Viewpoint for Engineers

IN SOME sections of the country the importance of commercial activities has eclipsed that of engineering in the eyes of executives. This is not surprising because the obtaining of new business and the holding of old constitute the most tangible means of securing revenue, and income is what interests the management. However, this is only part of the problem, as increased sales must of necessity result in increased investment and greater magnitude of operations. It is to the problem of production in its broadest sense that the engineer must direct his attention, with a keen appreciation of the relation of his work to successful business development. Too often engineers, possibly because of the nature of their early training and experience, fail to grasp the significance of these facts, with the result that they establish in the minds of business executives an excellent reputation as trained technicians, but give the general impression of being unfamiliar with the broader problems of management. Because of their natural aptitude for analyzing problems and obtaining solutions based on facts, engineers in our large utility companies have a much bigger opportunity than ever before to act as advisers on many of the major problems which face the industry today. However, they cannot afford to wait until called upon to give advice, but must assume the responsibilities of management, for which, by reason of their training, they are peculiarly fitted.

There is still another activity which engineers can undertake that will enhance their value to their companies, and that is active participation in public discussions regarding superpower, interconnection, water-power development, public versus private ownership, and other agitations on problems affecting the economies of production, operation and management. Unfortunately, owing to misinformation generally supplied from unreliable or inconsistent sources, the public has acquired some very fallacious impressions regarding these subjects. They cannot be removed except by utility men re-educating the public through individual conversations and talks before social, civic and commercial and other bodies where tangible facts are presented in a comprehensible manner. Fortunately for engineers, they have the information and unbiased reputation among the public which will enable them to do most effective work if they will only more openly express themselves on the problems which so vitally affect their industry.

Some engineers have recognized these greater responsibilities and are rendering service of inestimable value to the industry. The need for engineers to recognize more clearly their field of responsibility in problems of management outside of the purely technical duties which are a part of the engineering activities of our utilities is most strikingly evidenced in the work of the Technical National Section, N. E. L. A. Engineers who have not acquired a conception of what they can do to help in solving the utility problems can do no better than attend and take an active part in the Technical Section committee meetings of the association to gain the wide perspective and absorb the enthusiasm obtainable there. Primed with this knowledge, it becomes the engineer's obligation to place himself in such a position that he will be able to take a more active part in promoting the things for which he stands.

Plants Should Be Designed for Convenient Operation

OFTEN little things in the estimation of power-plant designers become the big things in the minds of the station operators. Lighting arrangements, the accessibility of storerooms, passageways, window and door locations and arrangements for handling equipment and repair parts are elements of design that have a decided bearing on operating convenience.

In the boiler room the lighting is a vital feature and yet it is very poor in most plants. A building elevator for handling heavy parts from basement to roof is a necessity. Monorails for conveying and electric hoists for lifting greatly facilitate repairs of coal, draft and auxiliary apparatus and yet are infrequently found. Even a little forethought in locating beam-clamp eye bolts will greatly lessen manual labor. In the turbine room the bridge crane is splendid for moving the parts on the main floor, but much of the equipment on the lower floors must be skidded, lifted over obstacles and again skidded before the crane can be brought into operation. Even more chaos exists in the arrangements for handling electrical equipment and for storing supplies and spare parts.

The operating staffs appreciate these minor elements of station design very much, and, in their opinion, designers can make or mar a station by neglecting to study the location of equipment with respect to handling it and its repair parts. Elevators, trucks, monorails, hoists and other material-handling equipment should be used more freely in power stations in order to expedite repairs, to reduce the number of operators and to permit operators to concentrate their attention on those essential elements which make for efficient station operating performance.

"Utilities' Fight to Success a Tip for Railroads"

SOMEHOW, somewhere there is always compensation for the hardships of life. Compensation, in the form of public confidence, good financial position and all that goes with these, is at present the pleasant lot of the public utility companies after the discouraging experiences of the war and pre-war period when it seemed as if a club awaited them at every turn. An indication of the degree to which those outside of the industry feel this to be true comes in an article by a financial writer in the Chicago *Tribune*, under the title quoted above. The author tells the railroad presidents, who, he says, "fear a congressional slaughter, with repeal of the transportation act, public ownership and red ruin," to take heart and bids them "look at their sister public services—the traction, lighting and gas corporations. A few years ago these companies were exactly where the railroads are now. It looked as if everybody was kicking them around. How is it today? Their securities are going right up—they are one of the best things in sight. The companies have been regulated and baited as much as ever the railroads were, but they have come out of the rut, thrived on fights and learned a lot."

Public recognition of the real utility position in the community is becoming very general. It is built on sincere efforts by the utility companies to establish a foundation of clean business methods. The future task will be to foster and maintain this growing good will.

35,000-Hp. Francis Type Units to Operate Under 857-Ft. Head

A NEW world's record will be established for high-head reaction-type hydraulic turbines when the Oak Grove project of the Portland (Ore.) Railway, Light & Power Company is completed. Construction work is now in progress on a hydro-electric development which will have an ultimate capacity of 100,000 hp. The first unit, which will be completed early in 1924, will develop 25,000 kw. and cost about $10,000,000. The hydraulic turbine for this project, which has just been ordered, will be a 35,000-hp., 514-r.p.m. Francis-type, single-discharge unit, operating under a head of 857 ft., made by the Pelton Water Wheel Company. This unit will establish a world's record for a reaction type hydraulic turbine. It will be similar to the Francis type turbines at the Kern River No. 3 plant of the Southern California Edison Company, which are of 25,000 hp. capacity, operating under a head of 810 ft., and which have stood as the world's record up until this time for reaction type turbines. No. 1 shows the character of the country through which a 20-mile wagon road has been built. For the greater part of the distance the road had to be blasted out of solid rock. No. 2 shows the site of the Oak Grove power house at the foot of the large knoll. The top of this knoll will be blasted off and a surge chamber constructed. No. 3 is a glimpse of the city of Portland, a center of industry and commerce in this region, where the power generated will be transmitted for distribution. The water to turn the wheels in the new project will come largely from the glaciers of Mount Hood.

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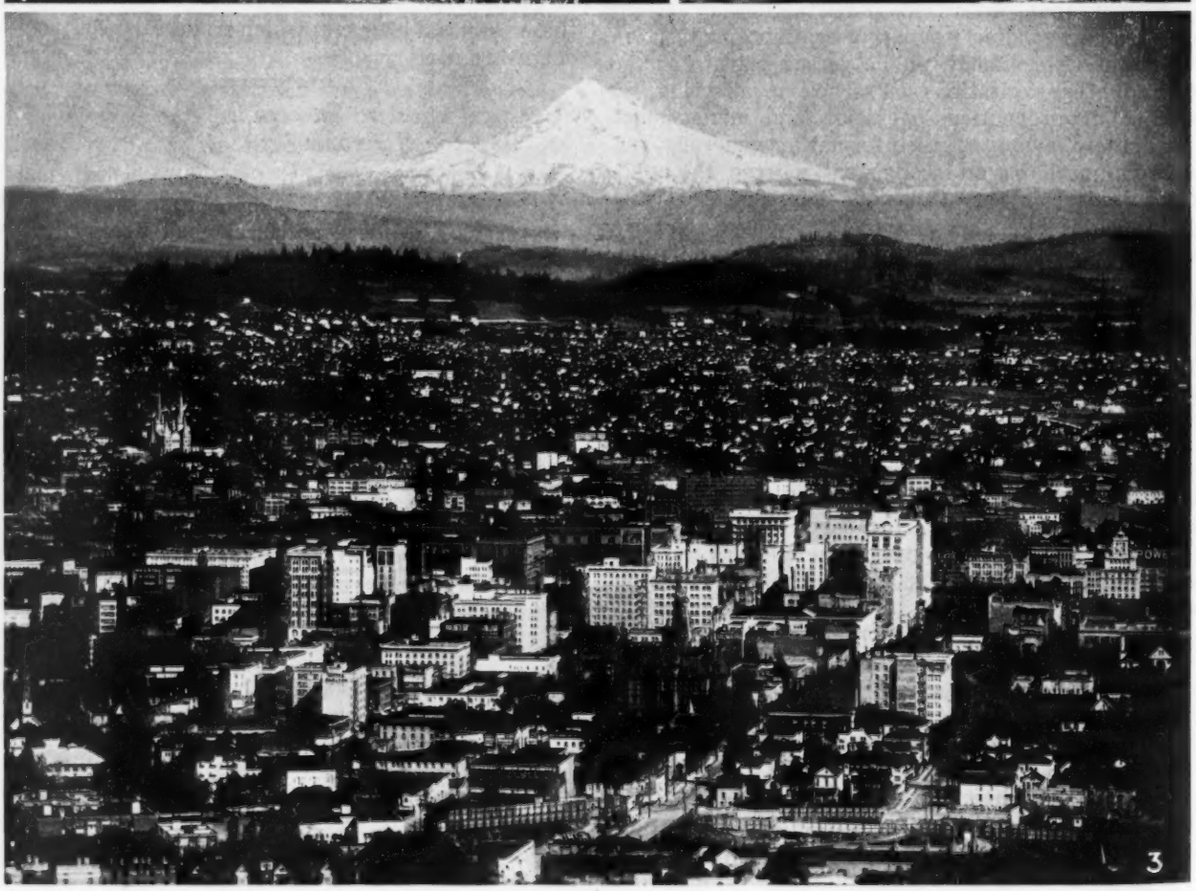


3

Graphic Solution for Wood-Pole Strength

Using Safety Factors and Chart of Diameters Gives Convenient Method for Choosing Poles—Checking Old Poles for Rot Weakness Made Convenient—Solution of Taper Problems Suggested

By EVALD BROKEMYR
Stone & Webster, Inc.

MANY engineers probably are inclined to work by rule of thumb when selecting wooden poles for use in new construction as well as in replacements, particularly if the factors involved are subject to repeated changes, as the length of the poles and the spans in a mountainous country are likely to be. Such practice is, however, apt to shoot far off the mark, for the rule of thumb usually does not take due regard of the circumstance that the moment of resistance of the pole follows the third power of the diameter. One of the consequences is that, in the case of maintenance, the influence of inside rot on the present strength of the pole will invariably be overestimated as compared with the effect of outside rot.

The nomographic chart often offers a convenient means for solving equations that are suitable or can be made suitable for representation by such a chart when the equation in question has to be applied to a large number of individual cases and the exactitude required is not too great. The accompanying chart illustrates the application of a nomograph to the finding of any one factor involved in the strength equation for a wooden transmission pole on tangent construction with regard to transverse wind pressure, when all the other factors involved are known.

The equation underlying the graph is developed in compliance with the method of calculating wooden poles given in the National Electrical Safety Code, Appendix B, for pole lines of certain grades, A, B, C, etc. Heavy loading conditions, as ruled in the code, were assumed, and the safety factor is given for a fiber stress at break of 3,600 lb. as well as 5,000 lb. per square inch—stresses which, according to the code, are to be employed when poles of certain kinds of wood are used.

It will be noted that in the graph, for the sake of convenience, the distinction between the conditions for lines of grades A, B and C with regard to the stress on the material is made by means of different safety factors, while in the examples given in the code different loading in the case of the different grades is assumed. The result is the same in both cases. Thus on the safety-factor line of the graph A_n, B_n and C_n indicate the safety factors required for new poles to be used in lines of grades A, B and C (3, 2, 1.33 respectively), and A_m, B_m and C_m the factors one-third less, which are the lowest permissible factors for the poles of the line in operation.

Needless to say, the graph can be applied not only to poles in lines of grades A, B and C, but also to poles where no grade is specified, a safety factor in this case being chosen.

The graph gives also a convenient means of judging poles that are found to be rotted, outside as well as at heart, as will be explained later. In the case of a power company that stubbed a large number of poles each year the stub-testing reports were transmitted from the field to the office, where the poles to be stubbed were decided upon. A chart, similar to the one presented, proved convenient for that work.

THEORETICAL BASIS FOR CHART

The equation for a pole subjected to bending is

$$B/F = 384M/\pi D_g^3 \qquad (1)$$

where B indicates the breaking fiber stress of the wood. Other symbols are explained in connection with the graph.

The bending moment caused by the wind pressure on the pole itself is:

$$M_p = 8 \times (D_m/12) \times H_t^2/2 = 0.333 \times D_m \times H_t^2 \qquad (2)$$

The wind pressure on the wires plus the ice layer is:

$$P_c = 8 \times (Q/12) \times S = 0.666 \times Q \times S, \qquad (3)$$

and the bending moment caused by the wind pressure on the wires, ice layer included:

$$M_c = P_c \times H_w. \qquad (4)$$

Thus the total bending moment:

$$M = M_c + M_p. \qquad (5)$$

Equations (1) to (5) give:

$$F = \frac{K \times D_g^3}{0.333 \times D_m \times H_t^2 + 0.666 \times Q \times S \times H_w} = \frac{K \times D_g^3}{M} \qquad (6)$$

in which the constant K is 40.9 for a breaking fiber stress of 5,000 lb. per square inch and 29.5 for a breaking fiber stress of 3,600 lb. per square inch.

On a nomographic chart there will of necessity be one axis for each variable in the equation to be represented, provided with numbering within a certain range. If the equation, as in this case, contains more than three variables, there will in addition be a certain number of intermediate or dummy axes, which are used as stepping stones in picking up the different variables, so to say. In the present case P_c is a dummy axis without scale, while the intermediate M_p-M_c-M axis had to be numbered because M_p and M_c have to be read there and added, in order to arrive at M, the scale being used for this latter variable also.

It will thus be noted that certain combinations of scales and intermediate axes represent certain subdivisions of the main equation, and these combinations only will give correct results when the chart* is applied. The combinations are:

D_m, H_t, M_p, representing equation	(2)
Q, S, P_c, representing equation	(3)
P_c, H_w, M_c, representing equation	(4)
M, D_g (or C_g), F, representing equation	(6)

*On the chart one single scale is used to indicate the values of M_p, M_c and M. Similarly one scale only is used for both H_t and H_w values.

The use of the graph can be best explained by an example. Suppose that the diameter of a new pole for grade A line requirements is to be determined under conditions as follows:

Fiber stress at break of the wood: 5,000 lb. per square inch.

Conductors: three wires No. 1 stranded plus static wire $\frac{3}{8}$ in. in diameter.

Span: 250 ft. and 150 ft. on either side of the pole; hence $S = 200$ ft.

Length of the pole: 45 ft.; hence $H_t = 38$ ft. and $H_w = 35$ ft. if it is supposed that the pole is set 7 ft. in the ground and that the center of the wire plan is 3 ft. below the top.

In order to find the bending moment on the pole caused by the wind pressure on the pole itself it will be first assumed that D_m equals 8 in. The chart is then used as follows:

1. Determine P_c at the intersection of the P_c axis with a straight line from the point (3 No. 1 str. + $\frac{3}{8}$) on the Q axis to the point 200 on the S axis.

2. Read M_c at the intersection of the M axis with a straight line from the P_c point just found to 35 on the H_w axis. $M_c = 24{,}800$.

3. Read M_p at the intersection of the M axis with a straight line from 8 on the D_m axis to 38 on the H_t axis; $M_p = 3{,}800$.

4. M_c plus $M_p = 28{,}600 = M$.

5. Read the ground diameter (or the ground circumference) at the intersection of the D_g axis with a straight line from 28,600 on the M axis to the point A_n on the F axis; $D_g = 12.8$.

A pole with a diameter of 13 in. at the ground line would thus fulfill the conditions. If the pole has, let us say, 7 in. top diameter, the mean diameter above ground would be 10 in., instead of the assumed 8 in. A repetition of the operation with a regard to this larger diameter would give a ground diameter of exactly 13 in. Generally speaking, a repetition of the operation with a corrected mean diameter will be necessary only in case the assumed mean diameter proves to be very incorrect, while the difference between the ground-line diameter, as found at the first operation from the chart, and the next larger diameter taken, as expressed in non-fractional or half-fractional number of inches, is comparatively small. This is because the bending moment, as caused by the wind pressure on the pole itself, is rather small compared with the moment caused by the wind pressure on the wires at the heavy ice load assumed, and further because the strength of the pole increases with the third power of the diameter.

In a similar manner any one factor can be found from the other factors involved being known. Suppose we had the pole in our example in store and wanted to know for how long a span it could be used, the operation would be as follows: From F and D_g determine M; from M subtract M_p as found from D_m and H_t, this

Chart

representing equation six for the strength of wooden transmission poles on tangent construction with regard to transverse wind pressure of 8 lb. per square foot cylindric surface.

As used the constant K is 40.9 for a breaking fiber stress of the wood of 5,000 lb. per square inch and 29.5 for a breaking fiber stress of 3,600 lb. per square inch, and the other symbols used having the following denotations:

H_t (ft.) = total height of the pole above ground.

H_w (ft.) = height of the pole above ground to the center of the wire plan.

S (ft.) = sum of half the spans on either side of the pole.

M_c (lb.-ft.) = bending moment on the pole caused by the wind pressure on the conductors with the ice layers.

M_p (lb.-ft.) = bending moment on the pole caused by the wind pressure on the pole itself.

M (lb.-ft.) = resulting bending moment: $M = M_p + M_c$.

P_c (lb.) = total wind pressure on the conductors, ice load included.

D_g (in.) = diameter of the pole at the ground line (or diameter of inside rot).

C_g (in.) = circumference of the pole at the ground line, (or circumference of inside rot).

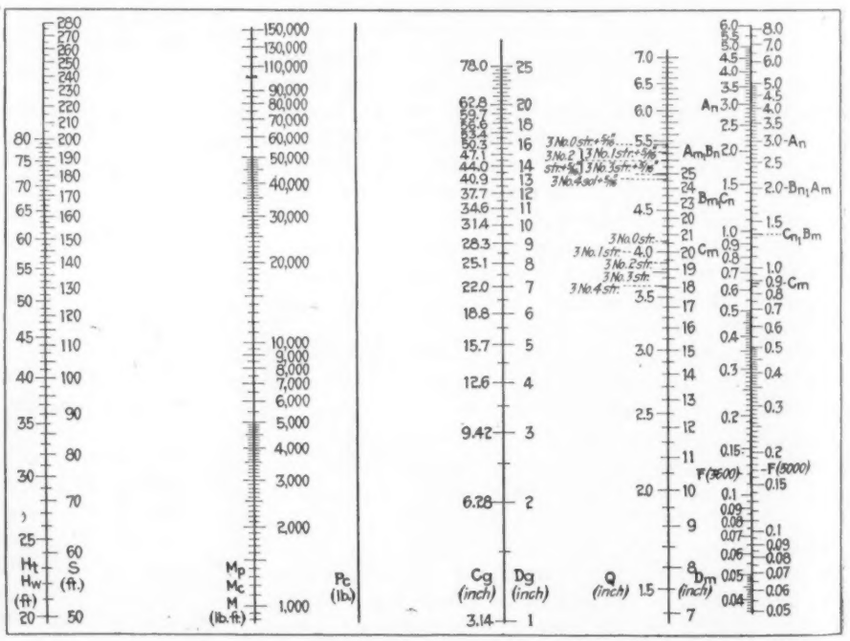
Q (in.) = sum of the diameters of the conductors, ice-loading layer included.

D_m (in.) = mean diameter of the pole above ground.

F (3,600) = safety factor of the pole with regard to the cross-section at the ground line, when the breaking fiber stress is assumed to be 3,600 lb. per square inch.

F (5,000) = safety factor of the pole with regard to the cross-section at the ground line, when the breaking fiber stress is assumed to be 5,000 lb. per square inch.

A_n, B_n, C_n, as marked on the F axis, indicate the points that correspond to the safety factors required for new poles to be used for A, B, C, grade conditions respectively.



A_m, B_m, C_m, as marked on the F axis, indicate the points that correspond to the lowest permissible safety factors during maintenance for poles in lines subject to A, B, C, grade requirements respectively.

3 No. 1 str. + $\frac{3}{8}$ in., etc., as marked on the Q scale, indicate the point that corresponds to the sum of the diameters plus 1 in. ice per wire of the standard combination of three stranded wires, No. 1, plus one $\frac{3}{8}$-in. static wire, etc.

Scale combinations to be used: (1) D_m, H_t, M_p. (2) Q, S, P_c. (3) P_c, H_w, M_c. (4) M, D_g (or C_g), F.

Note: $M = M_p + M_c$.

When the problem is to find D_g, first assume a value for D_m in order to arrive at M_p; if the assumed D_m proves to be very incorrect, repeat the operation with corrected D_m.

For other combinations of conductors than the ones indicated on the Q scale, the sum of the conductor diameters plus ice layer has to be computed and the corresponding point taken.

When the problem is to check poles for rot, subtract the safety factor corresponding to the diameter of the rot at heart from the safety factor corresponding to the outside diameter, in order to arrive at the actual safety factor.

The chart may be applied to any cross-section of the pole above ground, provided H_t and H_w are counted from the cross-section in question, instead of from the ground up.

In the case of a pole carrying a number of wires of different sizes and widely distributed, determine the moments as caused by the wind pressure on the wires individually or in groups, and add the several moments, instead of making all the wires in one group, and refer the wind pressure to the center of the wire plan for all the wires.

is M_c; mark point on the P_c axis corresponding to M_c and H_w; combine this point with Q and read S.

CHECKING FOR ROT

Now suppose some years later the pole is tested for rot and its safety factor at that time is to be determined. Let us suppose the rot is ¾ in. outside; D_g will thus be 11.5 in. The bending moment is arrived at as indicated (the mean diameter is in this case known to be 10 in.) and the safety factor is read at the intersection of the F axis with the extension of a straight line from the point on the M axis over 11.5 on the D_g axis: $F = 2.10$. This point being above the point marked A_m, the pole is still strong enough to meet the requirements of the code.

But suppose that the pole test gave evidence of 5 in. inside rot diameter in addition to the outside rot of ¾ in. From the same point on the M axis we find the safety factor corresponding to 5-in. diameter; $F = 0.17$. In subtracting this from $F = 2.10$, as found above, the actual safety factor is found to be $F = 1.93$. The pole in this condition would thus not meet the requirements and would have to be reinforced or replaced.

When working with the graph it will usually not be necessary to apply it to each individual pole. In a given line, or at least in a certain part of that line, many factors will be constant, such as number and sizes of wires, length of poles and length of spans. In the case of investigating rotted poles it will be convenient to make up a small table by help of the graph for those conditions, the table showing the largest permissible rot for the various pole diameters to be found in the line.

Graphs for medium and light loading conditions may be built up in a similar way to the chart here given for heavy loading conditions. For the wind pressure at medium and light loading, ruled to be two-thirds and four-ninths respectively of that at leavy loading, the constants in the equations corresponding to the equations (2) and (3) above will be 0.222 and 0.444 respectively for medium loading and 0.148 and 0.296 respectively for light loading. This means, when expressed on the graph, that the numbering on the Q axis and the D_m axis will be offset, as compared with the heavy loading graph, the graph otherwise remaining unchanged, with the same length for the logarithmic unit.

In case the dimensions, the breaking fiber stress of the pole and the loading conditions are such that a tangent drawn to a curve representing the moment of resistance of the pole divided by the safety factor as a function of the height has a less steep slope at the ground line than a tangent to a similar curve representing the total bending moment on the pole, the pole has a lower safety factor for a cross-section somewhere above ground than the one found for the cross-section at the ground line. The cause of this condition is excessive taper of the pole, since the moment of resistance of the pole decreases with the third power of the diameter, while the bending moment caused by the wind pressure on the wires increases directly with the distance from the center of the wire plan, and the bending moment caused by the wind pressure on the pole increases approximately with the second power of the distance of the cross-section from the top of the pole.

In case the first-mentioned curve at the ground line is steeper than the bending-moment curve at the same point, or equally steep, the safety factor found for the ground-line section is the lowest to be found anywhere at the pole. That this may be the case the taper must not be larger than as formulated below. If the bending moments on the pole, the moment of resistance of the pole and height above ground are used as variables, and further if:

M_r = moment of resistance of the pole on the basis of a fiber stress of B/F,
R = taper of the pole in inches per foot length of the pole,
$L = H_t - H_w$,
X = variable height above ground line,
p = wind pressure in pounds per square foot cylindric surface,

the following equations hold good:

$$M_r = (B/F) \times (\pi/384) \times (D_g - XR)^3, \quad (7)$$
$$M_c = (p/12) \times Q \times S \times (H_t - L - X), \quad (8)$$
$$M_p = (p/48)\,(H_t - X)^2 \times (2D_g - XR. - H_tR) \quad (9)$$

If the moment-of-resistance curve is parallel to the total bending-moment curve at the ground line, the derived functions of the two curves must be equal when X is made zero. This gives the equation for the maximum allowable taper when the safety factor is lower for the section at the ground line than for any section above ground:

$$R = p \times \frac{(D_g \times H_t + Q \times S)}{0.295 \times (B/F) \times D_g^2 + 0.25 \times p \times H_t^2} \quad (10)$$

This equation is not likely to be applied to each pole individually, but only to some typical cases which give the smallest taper (i.e., high poles with comparatively low load) and from which the taper or the top diameter of all the poles in the line is then decided upon. In case, however, it should be desired to apply the equation to a large number of poles, a nomographic representation of it may be convenient to use, made up in a similar manner to the one here presented for the pole strength equation.

Gases Liberated by High-Voltage Insulator Testing Apparatus

DURING the testing of porcelain insulators with a 60-cycle flashover apparatus both ozone and oxide of nitrogen are liberated, according to tests made by the Bureau of Mines and described in bulletin Serial No. 2497. It was found that the gases disappear just after the test and that no fatalities have ever resulted from these gases.

Oxides of nitrogen were not found in quantities greater than 0.2 part per million, the limit of accuracy of the method used. The ozone concentration of the gas samples taken directly above the racks during the tests varied from two to ten parts per million. From the information available on the physiological effects of ozone, the amount found in the tests should cause no serious symptoms or after-effects. However, it is advisable to have the test room ventilated at all times so as to reduce the ozone concentration below ten parts per million. This could be obtained by placing fans directly under the test racks so arranged as to blow the gases upward and away from the workmen. If these fans are operated for one or two minutes immediately after each test, this should be ample to remove the gases entirely.

Previous investigators reached the conclusion that six parts per million of ozone causes coughing after moderate exercise. Ten parts per million for a fifteen-minute exposure causes sore throat, and exposure for two hours to twenty parts may prove fatal.

Residence Heating by Electricity

Field Data of Energy Requirements — Temperature and Humidity Affect Results — Costs, Rates and Classified Uses—General Conclusions and Deductions

By E. A. LOEW
Associate Professor of Electrical Engineering, University of Washington

SOMEWHAT more than a year ago an article by the writer appeared in the ELECTRICAL WORLD in which data on the heating of residences by electrical energy were presented. The purpose of the article was not to advocate the use of the electrical method of heating, but to present and analyze the data made available by a rather extensive application of this kind. Electrical engineers will at once recognize the fact that there are certain very definite limitations to this application of electrical energy and that it is economically possible only under special conditions. To compete with coal, the selling price of energy, it was pointed out, must be between 0.5 cent and 0.75 cent per kilowatt-hour. A study of the amount of energy consumed by the average residence was made, and conditions and the types of heating units used, the energy rates in effect and other facts of interest pertaining to the application were pointed out. It was felt at that time that, entirely aside from the fact that the application of electrical energy to this service must perhaps always remain limited in scope as well as confined to isolated instances where a special set of conditions and circumstances make it possible, there is much information of value to be gained from a careful study of the application where it is made on a scale large enough to permit one to draw general conclusions.

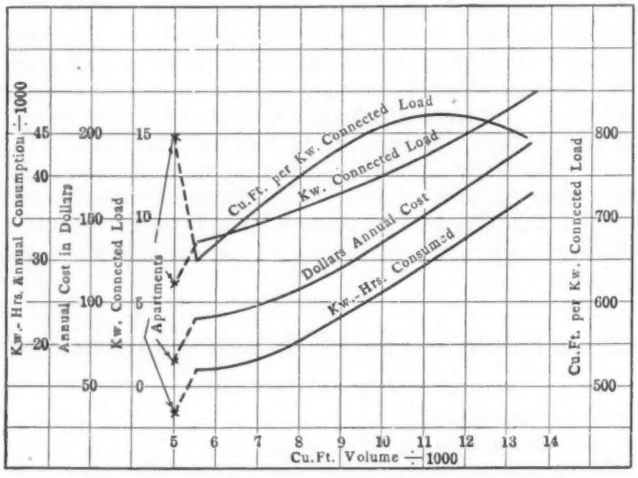


FIG. 1—COST, CONSUMPTION AND CONNECTED LOAD IN TERMS OF VOLUME HEATED

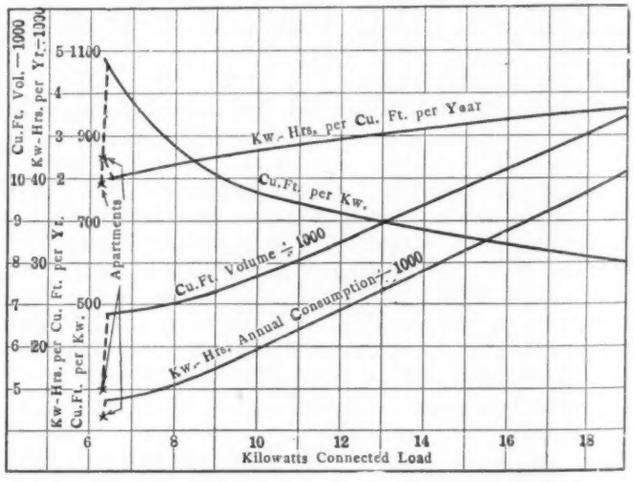

Cu.Ft. Vol. ÷ 1000
Kw.-Hrs. per Yr. ÷ 100
Kw.-Hrs. per Cu. Ft. per Yr.
Cu.Ft. per Kw.
Apartments
Kw.-Hrs. per Cu. Ft. per Year
Cu.Ft. per Kw.
Cu.Ft. Volume ÷ 1000
Kw.-Hrs. Annual Consumption ÷ 1000
Kilowatts Connected Load

FIG. 2—ENERGY CONSUMPTION AND HEATED VOLUME VERSUS CONNECTED LOAD

In the city of Tacoma, Wash., more than two thousand consumers are now and have for several years been heating their homes entirely or in part by electrical energy furnished by the municipally owned electric plant of about 20,000 kw. rating. At the present time the plant is fully loaded, and the city is building an additional plant, which, when completed, will have an installed machine capacity of about 85,000 kw. The present plan is to continue the sale of electrical energy for heating. Here, then, is an instance where this application has been practiced on a considerable scale for a number of years. The records have been kept in such shape that it is an easy matter to segregate the heating load from the remainder of a subscriber's load and in this way to analyze in detail the requirements for heating. Measurement records of the residences are also on file, as well as the connected heater load and the monthly meter readings. The opportunity is thus afforded for determining with a considerable degree of accuracy the energy consumption, month by month and year by year, of residences of various sizes and kinds, and by relating these to the outdoor temperature and other variables to draw conclusions as to the quantitative relations existing between these variables.

DATA OBTAINED

Through the co-operation of the light plant the following data were obtained covering the year 1921 for each one of about two thousand heating customers connected to the city's distribution system:

1. Name and address of consumer.
2. Connected load of consumer's heating plant, in kilowatts.
3. Measurement data pertaining to the consumer's residence. From these the floor space could be computed and the cubical contents estimated.
4. The kilowatt-hour consumption for each month of the year.

In addition to the above, the climatological data pertaining to the year and locality in question were obtained from the office of the United States Weather

TABLE I—SUMMARY OF HEATING LOAD OVER A THREE-YEAR PERIOD

Item	Year 1919	1920	1921
Total number of customers	547	925	1,978
Total number of full-year customers	139	423	1,017
Total kw.-hr. consumption	.....	8,860,000	18,712,000
Average kw.-hr. consumption per customer	.....	8,580	9,470
Total kw. connected load	3,625	6,104	12,760
Average kw. connected load per customer	6.65	6.60	6.45
Total income for the year	$19,490.00	$49,400.00	$97,400.00
Average annual income per customer	$35.60	$53.00	$49.25
Average annual income per kw. connected load	$10.00	.....	11.80
Average rate per kw.-hr. sold, cents	0.52	0.557	0.552
Number of customers using 4 kw. or more the full year	103	305	678
Average connected load of full-year customers using 4 kw. or more	8.17	8.48	8.67
Average yearly income per customer using 4 kw. or more full year	.....	$85.00	$73.50
Total income from customers using 4 kw. or more full year	.....	$26,000	$74,750

Bureau. Of the latter the items which have more or less bearing on the consumption of energy for heating are given in Table VII.*

A few words of explanation with regard to items 2, 3 and 4 seem desirable. Item 2 is subject to change from year to year and must for this reason and because of its bearing on the annual minimum charge for energy be checked up from time to time. This is done by inspectors who go from house to house and with all of the heating load turned on take meter readings. The heating load and the lighting, cooking and appliance load are metered separately. The reading of the heating-circuit meter therefore determines the connected load to be used in computing the minimum charge until the next check is made. This method of checking has worked out very successfully.

Item 4 corresponds to the consumer's monthly statement for heating energy used. The meter readings on which the bills are based as well as the bills themselves are prepared from day to day, and the bills are mailed out when ready. Thus the April bill, for example, of the consumer whose meter is read near the first of the month is in reality the bill for March consumption, while the corresponding bill for a consumer whose meter is read near the end of the month is largely for April consumption. In averaging up these bills and the corresponding consumptions, therefore, it must be borne in mind that the average April values are values of the last half of March and the first half of April, the center of the consumption month being on April first. This observation is made here to explain why

*For more complete data see University of Washington Engineering Experiment Station Bulletins Nos. 15 and 20, "Electrical Heating of Residences," by E. A. Loew.

Each subscriber is required to fill out a measurement card before receiving connection to the city's circuit. This card lists the total occupied floor space of residence as either "working space" or "idle space." Basements, attics, clothes closets, porches and outbuildings, unless used for purposes bringing them within one of these classes, are not considered. The "equivalent floor space" is defined as the total square feet of floor space in the working area plus one-half the square feet of floor space in the idle area. In the tabulations which follow the equivalent floor space is not used, but the volume is estimated on the basis of the total floor space, equal to the sum of the total square feet of working space and the total square feet of idle space. The volume, or cubical contents, of the residence is then estimated on the basis of the total floor space computed as above and an assumed ceiling height of 9 ft. It is apparent that the figure thus determined is perhaps considerably less than the figure one would get by using the outside dimensions of the residence to determine the floor space and the studding height for the ceiling height. However, for purposes of making a comparative study of the energy requirements of residences of different sizes, this method of computing comparative volumes should be quite satisfactory and convenient from all standpoints.

The annual cost of energy is calculated on the basis of 0.5 cent per kilowatt-hour, which is the heating rate in effect unless the total annual charge thus computed is below the minimum of $9 per kilowatt of connected load per annum, in which case the minimum charge is applied. A considerable percentage of certain classes of consumers pay in excess of the 0.5-cent rate on account of the application of the minimum.

RESIDENCES CLASSIFIED

For purposes of this study residences were classified as follows:

1. As to cubical contents.
2. As to number of kilowatts of connected load.
3. As to type, that is, isolated residences and apartments.

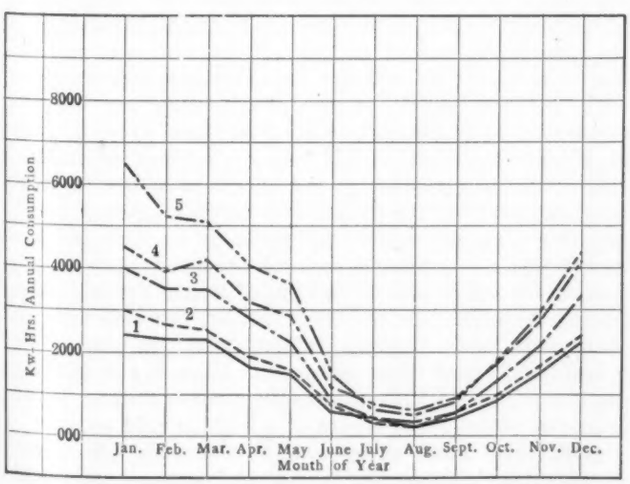


FIG. 3—MONTHLY ENERGY CONSUMPTION BY CLASSIFIED GROUPS OF CONSUMERS

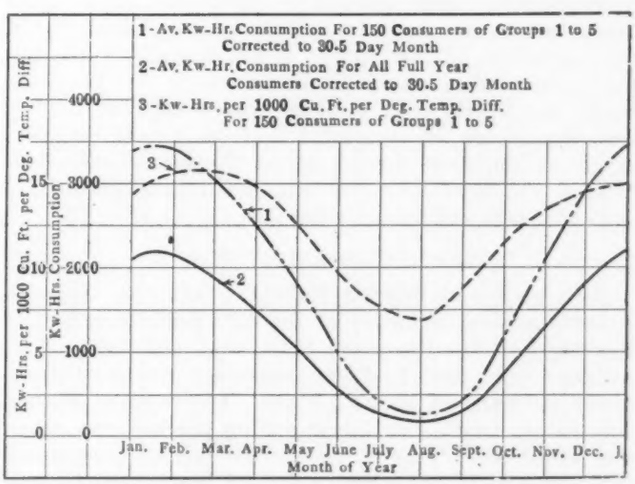

1-Av. Kw-Hr. Consumption For 150 Consumers of Groups 1 to 5 Corrected to 30.5 Day Month
2-Av. Kw.-Hr. Consumption For All Full Year Consumers Corrected to 30.5 Day Month
3-Kw-Hrs. per 1000 Cu. Ft. per Deg. Temp. Diff. For 150 Consumers of Groups 1 to 5
Kw.-Hrs. per 1000 Cu. Ft. per Deg. Temp. Diff.
Kw.-Hrs. Consumption
15
10
5
0
4000
3000
2000
1000
0
1
2
3
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. J.
Month of Year

FIG. 4—MONTHLY CONSUMPTION OF ENERGY CORRECTED FOR A 30½ DAY MONTH

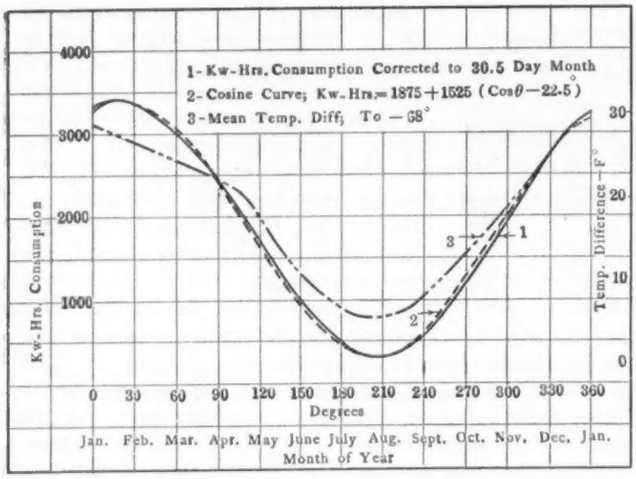

1-Kw-Hrs. Consumption Corrected to 30.5 Day Month
2-Cosine Curve; Kw-Hrs.=1875+1525 (Cos θ−22.5°)
3-Mean Temp. Diff; To −68°
Kw-Hrs. Consumption
Temp. Difference-F°
Degrees
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec. Jan.
Month of Year

FIG. 5—VARIATION OF CONSUMPTION WITH MONTHLY TEMPERATURE CHANGES

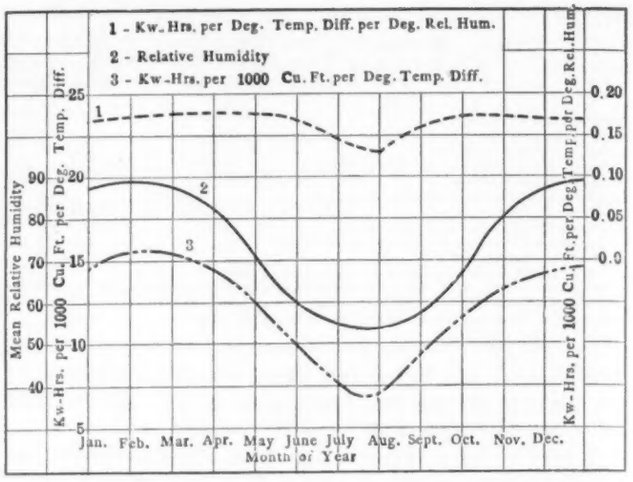

1 - Kw.-Hrs. per Deg. Temp. Diff. per Deg. Rel. Hum.
2 - Relative Humidity
3 - Kw.-Hrs. per 1000 Cu. Ft. per Deg. Temp. Diff.
Mean Relative Humidity
Kw.-Hrs. per 1000 Cu. Ft. per Deg. Temp. Diff.
Kw.-Hrs. per 1000 Cu. Ft. per Deg. Temp. per Deg. Rel. Hum.
Jan. Feb. Mar. Apr. May June July Aug. Sept. Oct. Nov. Dec.
Month of Year

FIG. 6—CONSUMPTION AS AFFECTED BY TEMPERATURE DIFFERENCE AND RELATIVE HUMIDITY

4. As to type of heating plant, into portable heater and furnace plants.

Classification by volume:	Cubic Feet
Group 1—Residences having cubical contents from	4,500 to 6,300
Group 2—Residences having cubical contents from	6,300 to 8,100
Group 3—Residences having cubical contents from	8,100 to 9,900
Group 4—Residences having cubical contents from	9,900 to 11,700
Group 5—Residences having cubical contents from	11,700 to 15,300

Classification as to Type:

Group 6—Apartments

Group 7—Residences having electric furnace plants.

Classification as to Connected Load	Kilowatts
Group 8—Residences with connected load of from	6 to 8
Group 9—Residences with connected load of from	8 to 10
Group 10—Residences with connected load of from	10 to 15
Group 11—Residences with connected load of from	15 or more

The classifications are, of course, not exclusive with respect to one another, and a given residence may be classed in more than one of the various groups. An apartment, for example, may be found in each of the groups 1, 6 and 8, while a certain residence of group 3 may also appear in groups 7 and 9. In listing residences only those were chosen from which the heat energy required was largely or wholly furnished electrically throughout the entire year. A very large percentage of the subscribers who are provided with connections for heating supplement a small amount of electrical heating with heating by wood-burning or coal-burning stoves. It is impossible to determine simply by inspection of the records which consumers use the electrical method only. However, except for the very small residences, it is unlikely that consumers having less than 6 kw. of connected load could heat satisfactorily by electrical energy alone. Consumers with less than 6 kw. were therefore eliminated from consideration and were not listed in the above groups.

GROWTH OF THE HEATING LOAD

As a matter of interest Table I is included. Here is given a general summary of the data pertaining to the heating load for the years 1919, 1920 and 1921. The average connected load per consumer remained relatively constant at about 6.5 kw. The average annual income per heating customer during the last two years was about $51. This represents the income from heating only and is the average for all heating customers connected to the system. If all consumers having less than 4 kw. of connected load be excluded, the average figure for the last two years becomes about $80. The average selling price of energy for heating was 55 mills per kilowatt-hour, or 5 mills in excess of the established rate.

In Table V a number of typical consumers belonging to group 1 are listed, together with the pertinent data pertaining to their respective consumption. These are listed in detail in order to afford a better picture of the variations in the several items as between consumers of a given class. The best index to the comparative energy requirements for heating, and one which will serve to compare the requirements of consumers of the different classes, is the "kilowatt-hours per 1,000 cu.ft. per annum." The average value of this figure is fairly constant for all the different groups. It is lowest for the group containing apartment dwellers only and highest for the group having furnace installations. This is to be expected, since these two groups represent the extremes.

Apartments are usually small and compactly built. The exposed superficial area upon which radiation depends is relatively small per unit of volume inclosed. An apartment on any floor except the lowest and the highest in a given building will have its floors and ceilings as well as its inner walls heated by energy liberated in adjacent apartments. Furthermore, the heating plant in nearly every case consists of portable heaters which radiate the energy liberated directly into the space to be heated, and the efficiency of heat utilization is accordingly 100 per cent. Residences provided with furnace plants, on the other hand, are isolated residences with relatively more superficial area per unit of volume inclosed, with a lower efficiency of utilization owing to radiation in the basement where the furnace is installed and with a less flexible heating plant, and therefore one which will probably be operated less economically. It should also be observed that 50 per cent of the apartments listed failed to use the minimum energy requirement of 1,800 kw.-hr. per kilowatt of connected load, whereas among the consumers of group 6 only two were penalized. Thus the apartment dweller seems to have a greater reserve and is better prepared to meet the rigors of a sudden cold snap.

A further point of interest is the wide divergence which exists between the largest and smallest values of specific consumption. Thus among the furnace plants the specific consumption ranges from a maximum of

TABLE II—ENERGY CONSUMPTION FOR RESIDENCES FROM 6,300 CU.FT. TO 8,100 CU.FT. VOLUME

Number of consumers considered, 29. Average connected load, 10.1 kw. Average estimated volume, 7,310 cu.ft. Average ratio of working space to idle space, 2.02. Average annual load factor, 20.9 per cent.

Month	Kw.-hr. Consumption, Total	Kw.-hr. Consumption, Average	Per Cent Yearly Total	Average Cost	Kw.-hr. per 1,000 Cu.Ft.	Average Cost per 1,000 Cu.Ft.	Average Outdoor Temp., Deg. F.	Average Temp. Difference to — 68 Deg. F.	Kw.-hr. per 1,000 Cu.Ft. per Deg. Temp. Difference
January....	86,300	2,980	16.1	$16.10	407	$2.20	40.3	27.7	14.7
February...	77,882	2,680	14.5	14.45	353	1.98	42.8	25.2	14.0
March.....	72,466	2,495	13.5	13.50	341	1.85	44.6	23.4	16.3
April.....	55,452	1,910	10.3	10.30	261	1.41	47.2	20.8	12.5
May.....	45,373	1,560	8.4	8.35	214	1.14	53.6	14.4	14.9
June.....	21,555	742	4.0	4.00	101	.55	60.0	8.0	12.6
July.....	10,194	350	1.9	1.90	48	.26	61.4	6.6	7.3
August.....	7,597	262	1.4	1.40	36	.19	62.2	5.8	6.2
September..	15,475	533	2.9	2.90	73	.40	56.3	11.7	6.2
October....	29,625	1,020	5.5	5.45	140	.75	53.2	15.7	8.8
November..	47,977	1,655	8.9	8.90	226	1.23	45.6	22.4	10.1
December..	67,922	2,340	12.6	12.60	320	1.72	38.4	29.6	10.8
Total....	537,818	18,527	100.0	$99.85	2,520	$13.68	....	....	134.4
Average..	.....	.....	.....	.....	.....	.....	50.4	17.6	11.2

TABLE III—ENERGY CONSUMPTION FOR RESIDENCES FROM 9,900 CU.FT. TO 11,700 CU.FT. VOLUME

Number of consumers considered, 19. Average connected load, 13.3 kw. Average estimated volume, 10,850 cu.ft. Average ratio of working space to idle space, 2.8. Average annual load factor, 26.3 per cent.

Month	Kw.-hr. Consumption, Total	Kw.-hr. Consumption, Average	Per Cent Yearly Total	Average Cost	Kw.-hr. per 1,000 Cu.Ft.	Average Cost per 1,000 Cu.Ft.	Average Outdoor Temp., Deg. F.	Average Temp. Difference to — 68 Deg. F.	Kw.-hr. per 1,000 Cu.Ft. per Deg. Temp. Difference
January....	87,180	4,590	15.0	$23.20	423	$2.14	40.3	27.7	15.3
February...	74,878	3,940	12.9	19.90	363	1.85	42.8	25.2	4.4
March.....	78,234	4,120	13.4	20.70	380	1.91	44.6	23.4	16.2
April.....	60,153	3,170	10.3	15.90	292	1.47	47.2	20.8	14.0
May.....	54,948	2,890	9.5	14.65	266	1.35	53.6	14.4	18.5
June.....	23,103	1,215	4.0	6.15	112	.57	60.0	8.0	14.0
July.....	13,662	720	2.3	3.55	66	.33	61.4	6.6	10.0
August.....	10,172	536	1.8	2.80	50	.26	62.2	5.8	8.6
September..	16,460	866	2.8	4.30	80	.40	56.3	11.7	6.8
October....	33,704	1,775	5.8	8.95	164	.83	52.3	15.7	10.5
November..	50,269	2,650	8.6	13.20	244	1.22	45.6	22.4	10.9
December..	79,239	4,170	13.6	21.00	384	1.95	38.4	29.6	13.0
Total....	582,000	30,642	100.0	$154.30	2,824	$14.28	....	....	152.2
Average..	.....	.....	....	.....	...	....	50.4	17.6	12.7

TABLE IV—SUMMARY OF ENERGY CONSUMPTION OF ALL KINDS

Group No.	No. of Consumers in Group	Average Kw.-hr. Consumed per Year	Average Cost to Consumer	Average Estimated Volume, Cu.Ft.	Average Ratio of Working Space to Idle Space	Kw.-hr. Consumed per Cu.Ft. per Year	Annual Cost per 1,000 Cu.Ft.	Average Kw.-hr. per Year per 1,000 Cu.Ft. per Deg. Temp. Difference	Average Connected Load in Kw.
1	50	16,680	$89.50	5,520	2.9	3.0	$16.15	13.5	8.4
2	29	18,527	99.85	7,310	2.02	2.5	13.70	11.2	10.1
3	40	25,197	130.65	9,840	2.7	2.6	13.32	11.0	12.2
4	19	30,642	154.30	10,850	2.8	2.8	14.28	12.7	13.3
5	12	37,083	187.80	13,400	1.8	2.8	13.95	12.0	16.9
6	51	11,900	65.70	5,000	2.4	2.4	13.15	10.3	6.3
7	18	33,209	171.15	9,660	2.1	3.4	17.72	14.3	14.6
8*	119	13,718	72.30	6,780	2.4	2.0	10.73	8.6	6.4
9	58	16,858	90.50	7,090	2.7	2.4	12.65	10.3	8.9
10	73	23,841	126.90	8,820	2.2	2.7	14.40	12.0	11.9
11	25	40,460	209.40	11,300	2.0	3.6	18.60	15.6	19.0

* A considerable percentage of the subscribers of group 8 used auxiliary heat.

6.1 kw.-hr. to 1.6 kw.-hr. per 1,000 cu.ft. per annum. Naturally, considerable differences are bound to exist for a number of reasons, among which personal preferences as to temperatures required for individual comfort, the presence or absence of strong incentives to the practicing of economy in the use of energy, the number in a family and the extent to which the residence is continuously occupied are perhaps the principal ones.

Average figures for members of the groups having the lowest and highest load factors are given in Tables II and III. The average consumption for these groups is here tabulated month by month in order to show the effect on consumption of outdoor temperature and other climatic conditions. The mean monthly temperature for the locality is given in column 8, while the ninth column gives the mean monthly temperature difference between out of doors and an assumed indoor temperature of 68 deg. F. The last column in the table gives the consumption per unit volume per degree temperature difference. This figure varies with the season of the year on account of the changing humidity, as will be shown later. However, these figures obtained for a given community under given climatic conditions should be fairly applicable to other communities under different conditions, provided that houses are equally well built in every case, that the average humidity is not greatly different and that varying exposure to winds does not introduce appreciable errors.

Perhaps one of the most interesting relations brought out in the present study is the relation between energy consumption for heating and the

TABLE V—INDIVIDUAL CONSUMPTION OF ENERGY BY SMALL RESIDENCE CONSUMERS

Customer No.	Kw.-Hr. Consumption— Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total Kw.-Hr.	Cost	Cu.Ft. Vol.	U.S.P. I. S. P.	Kw.-Hr. per Cu.Ft. per Year	Kw. Conn. Load
1	2,641	2,537	2,744	1,937	1,641	777	520	293	768	1,178	1,620	2,111	18,767	$93.85	5,610	2.7	3.3	10.1
2*	2,620	2,313	2,643	1,734	1,583	618	421	.....	442	1,008	1,185	2,577	17,144	103.50	6,300	2.6	2.7	11.5
3*	2,651	3,243	3,415	2,911	2,229	1,165	474	422	476	960	1,607	2,965	22,518	115.20	5,460	2.7	4.1	12.8
4	2,125	1,551	3,864	2,128	3,303	1,313	995	811	1,232	1,947	2,899	3,606	25,774	128.90	5,940	2.9	4.3	12.3
5*	2,472	2,514	2,583	1,865	1,914	950	620	462	500	964	1,210	2,041	18,095	103.50	5,760	1.8	3.1	11.5
6*	2,584	2,566	2,318	2,001	1,708	864	684	342	445	810	1,327	2,249	17,898	96.30	5,850	3.3	3.1	10.7
7*	2,500	2,371	2,454	1,869	1,764	670	378	206	348	797	1,374	1,884	16,615	86.40	4,650	2.6	3.6	9.6
8*	2,500	2,132	724	1,199	1,128	379	268	135	268	508	924	1,117	11,282	83.60	5,390	3.8	2.1	9.3
9*	2,407	2,385	2,690	1,894	1,601	510	258	.....	100	282	522	819	13,468	86.40	4,510	1.7	3.0	9.6
10	3,500	2,699	3,182	2,133	2,049	965	551	363	590	1,007	1,587	2,637	21,263	106.30	4,510	1.9	4.7	9.2
11*	1,505	1,897	2,266	1,699	1,645	629	345	239	257	750	1,464	1,500	14,196	85.50	5,520	2.6	2.6	9.5
12	2,824	2,000	828	1,476	1,477	600	.....	.....	1,051	869	1,513	2,656	15,294	76.50	5,580	3.1	2.7	8.1
13	2,782	2,502	2,544	1,969	1,790	1,013	908	667	987	1,383	1,593	2,383	20,521	102.60	5,630	4.3	3.9	6.8
14	1,705	1,785	1,770	1,490	1,354	878	650	449	522	1,018	1,283	1,243	14,147	70.74	6,150	3.8	2.4	6.0
15	2,005	1,962	1,818	1,341	1,003	393	.....	.....	163	550	1,320	2,093	12,678	63.90	5,070	2.8	2.7	7.1
16	1,883	1,746	1,466	1,630	1,320	359	189	.....	194	508	1,191	2,003	12,489	62.45	6,070	3.0	2.2	6.3
17	3,200	2,814	2,473	1,805	1,570	404	273	101	554	1,021	1,539	2,379	18,133	90.65	5,850	2.4	3.3	6.0
18*	2,064	2,398	958	543	433	.....	.....	134	.....	480	907	2,027	9,944	54.00	6,150	3.3	1.7	6.0

* Starred consumers paid the minimum of $9 per kw. connected load.

temperature difference between indoors and outdoors. Several sets of curves illustrating this relation are presented. The first is shown in Fig. 3. Here each of the numbered curves shows the month-by-month energy consumption for the corresponding group. The average consumption for all is shown by curve 1 of Fig. 4. The corresponding variation of temperature difference is shown by Fig. 5. A great similarity between the shape of the consumption curves and the temperature difference curves will be noted. As already pointed out, the consumption for a given month is in reality the consumption for one-half the current month plus one-half the previous month on the average. However, the values of temperature difference are in every case the mean values for the current month. For these reasons the values of consumption are plotted on the first of the month while the temperature differences are plotted on the fifteenth of the month. Irregularities (Fig. 3) are due to two principal causes, namely, marked variations from normal in the weather conditions and differences in the number of days included in the billing. Irregularities due to weather conditions have been verified by reference to climatological data, the high point during the month of May being a good example. Inequalities in the time included in the billing are well illustrated by the low points in February. By correcting all months to a thirty-and-one-half-day basis and then drawing a smooth curve through the corrected values, the curves of Figs. 4, 5 and 6 are obtained.

The resulting smooth curves are found to be very nearly simusoidal. This is illustrated by the curves of Fig. 5, showing the average monthly consumption in percentage of yearly total for 375 customers during 1921, the corresponding temperature difference curve and the sinusoidal curve. The agreement between the cosine curve and the energy curve plotted from the data is exceedingly good throughout the year. The error introduced when computing the energy required for the year from the cosine curve is only 0.75 per cent. While it is unfair to draw any general conclusions from these curves, yet it seems likely that a close approximation to the energy requirements for heating for an average season in this locality may be closely predicted from the simple sine curve.

INFLUENCE OF HUMIDITY

That humidity is an important factor in determining the amount of heat energy required for comfort is clearly illustrated by the curves of Fig. 6. It is there shown that the kilowatt-hour consumption per 1,000 cu.ft. per degree temperature difference is greatest during the months of high humidity and least during the months of low humidity, the average maximum and minimum values for the 150 consumers considered being 16.1 and 6.3 respectively. A smooth curve plotted through the month-by-month values shows the usual winter peak and summer valley. Upon plotting the humidity curve its shape was found to correspond closely to the shape of the specific energy consumption curve. Thus, by dividing the average values of kilowatt-hours per 1,000 cu.ft. per degree temperature difference by the corresponding values of the relative humidity curve 1 of Fig. 6 is obtained. This is approximately a straight line if the values for the summer months be omitted, and these values should properly be omitted since most consumers heat very little or not at all during these months. It may, therefore, be stated that the kilowatt-hours per 1,000 cu.ft. per degree of temperature difference per degree of relative humidity is practically constant for the nine heating months of the year, the average figure for the 150 consumers considered being 0.172 on the nine-month basis. On the basis of twelve months the average value is 0.165. These figures should be of value in determining or predicting energy requirements for heating, not only for the Puget Sound country, but anywhere. As previously pointed out, the type of construction used will, of course, also have to be considered.

TABLE VI—LOAD FACTORS AND VOLUME HEATED PER KILOWATT

The nine-month load factor is computed on the basis of the actual kilowatt-hours used during the nine months in question. (The three months of lowest consumption are omitted.)

Group No.	Average Kw. Connected Load	Average Kw.-hr. Annual Consumption	Annual Kw.-hr. Consumed per Connected Kw.	Per Cent Load Factor, Nine-Month Basis	Per Cent Average Annual Load Factor	Cu.Ft. Heated per Kw. Connected Load
1	8.5	16,680	1,970	27.9	22.5	654
2	10.1	18,527	1,830	26.1	20.9	724
3	12.2	25,197	2,060	29.7	23.6	806
4	13.3	30,642	2,300	32.6	26.3	817
5	16.9	37,083	2,190	31.5	25.0	794
6	6.3	11,900	1,890	27.0	21.6	794
7	14.6	33,209	2,270	34.5	25.9	662
Average	....	.....	.....	29.9	23.7	764

DIVERSITY FACTOR

It is very difficult to get reliable data on the diversity of the heating load alone because the usual lighting and appliance loads are fed from the same transformers. Several attempts have been made to determine what this factor is for a limited number of residences and apartments, as a result of which it seems clear that some diversity does exist and that the diversity factor is somewhere in the neighborhood of 1.6. This diversity is due to the varying habits of consumers, to the fact that a considerable number of residents are away from home during the afternoons and evenings, and to the further fact that a large number of the homes using electrical energy for heating use it as auxiliary to a coal or wood heating plant.

TABLE VII—CLIMATOLOGICAL DATA FOR TACOMA—1921

Item	Month of Year: Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Mean temperature	40.3	42.7	35.0	47.2	53.6	60.0	61.4	62.2	56.3	52.3	45.6	38.4
Departure from normal	+2.2	+2.3	+0.4	—1.7	—0.9	+0.6	—2.0	—0.8	—1.3	+1.7	+1.5	—1.9
Precipitation in inches	5.92	5.53	4.36	2.2	2.1	1.64	0.01	1.18	1.59	2.77	6.82	7.36
Departure from normal	+0.14	+0.4	+0.38	—0.56	—0.44	—0.49	—0.65	—0.48	—0.88	—0.63	—1.71	+0.03
Total snow unmelted	2.5	8.0	1.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	11.0	3.5
Greatest precipitation in twenty-four hours	1.67	1.17	2.23	0.5	1.06	0.49	0.01	0.43	0.56	0.48	1.38	3.07
Number of days precipitation was 0.01 in. or more	24	19	16	16	9	15	1	7	13	14	21	15
Clear	0	1	2	1	9	0	7	3	3	6	0	1
Partly cloudy	8	9	13	14	13	15	21	21	16	7	4	7
Cloudy	23	18	16	15	9	15	3	7	11	18	26	23
Prevailing wind	S.W.	S.W.	S.W.	S.W.	N.	N.	N.	N.	S.W.	N.	S.W.	N.E.
Mean relative humidity	88	89	86	78	57	62	54	57	60	74	86	87
Average wind velocity, miles per hour	7.9	6.3	6.5	7.3	6.1	5.5	5.7	6.1	6.1	5.8	6.5	6.9

Inter-Scandinavian Superpower Project

Possibility of Transmitting Power from Norway to Denmark—220-Kv. Direct Current Competes Economically with 132-Kv. Three-Phase—Plans Call for 80-Mile Submarine Cable or 3-Mile Aerial Crossing on 650-Ft. Steel Towers

TWO years ago an inter-Scandinavian commission was appointed by the governments of Denmark, Sweden and Norway to investigate the possibilities of an economical transmission of some of the hydro-electric energy from mountainous Norway to densely populated Denmark, a country which is virtually devoid of every natural source of power. The report of this commission was recently made public. Although the result of its work undoubtedly shows that the project will be difficult of realization economically until construction costs decrease and a bigger power market can be developed in Denmark, the report is of considerable value because a great number of possible alternatives were investigated in detail. With respect to the engineering solutions considered the report offers some remarkably interesting comments.

Of four alternatives finally chosen as the most practicable, two are based upon the use of two-conductor, 220,000-volt direct-current transmission by the Thury constant-current series system, while the two others favor a 132,000-volt, three-phase transmission line.

MARKET FOR ENERGY IN DENMARK STILL TO BE DEVELOPED

Within ten or fifteen years the power demand in Denmark will probably reach 500,000,000 kw.-hr. a year, with a peak load of 157,000 kw. on a load factor of 37 per cent. Obviously it would not be economical to build a transmission plant for such a load, but an analysis of Danish conditions has shown that a base load of 410,000,000 kw.-hr. could be delivered with a maximum demand of 63,000 kw., corresponding to a load factor of 76 per cent. For the estimates two-thirds of the latter amount was chosen as a basis for the first stage of development.

Under these conditions the figures for the four contemplated alternate schemes are surprisingly close together, the cost a kilowatt-year delivered at 50,000 volts at five important load centers in Denmark being estimated at from $48 to $53, with a decrease to about $38 a kilowatt-year when the load increases to 100,000 kw. The prices current in the spring of 1922 were used in the estimates, and the costs will have to be corrected according to prevailing prices. The estimated cost of the entire transmission plant varies from $10,500,000 for the cheaper direct-current project to $12,200,000 for the more expensive of the three-phase alternatives. Very nearly one-half of the total yearly cost of the power is determined by the cost of energy in Norway, which was estimated at $17 a kilowatt-year. The other half of that cost is made up of a 10 per cent annuity on the investment.

According to the more favorable of the two direct-current transmission schemes, power would be transmitted directly from Norway to Denmark through an 80-mile cable in Skagerack as shown on the map (Fig. 1). The plan calls for three single-conductor cables,

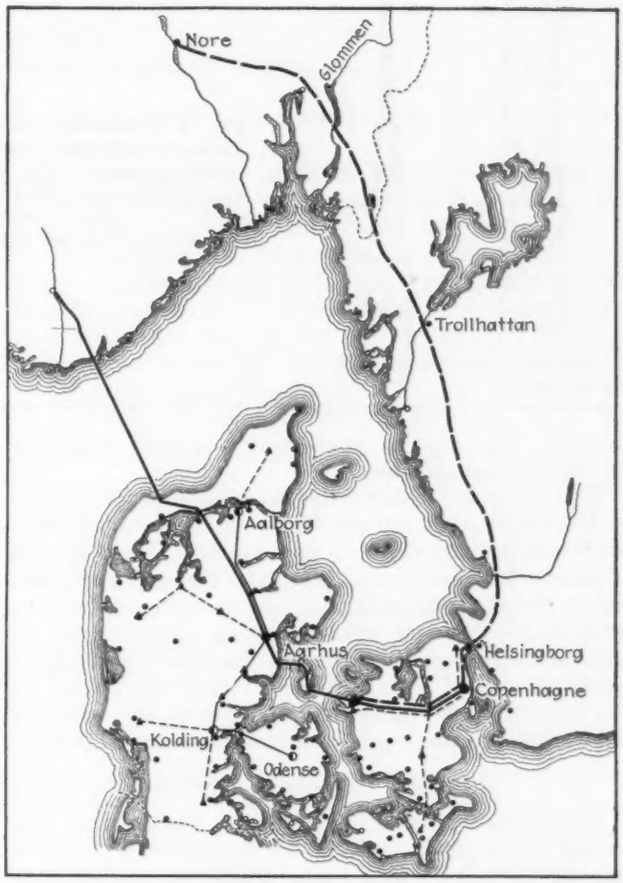


FIG. 1 — PROJECTED TRANSMISSION LINE FOR 132,000-VOLT, THREE-PHASE ENERGY FROM NORWAY TO DENMARK WITH 110,000-VOLT DIRECT-CURRENT CABLES IN THE NORTH SEA

each insulated for 110,000 volts to sheath. One of these would be a reserve cable, although normally running in parallel with one of the others. The copper area required is 185 sq.mm. (365,000 circ.-mil), and the cost of the cables is about 16 per cent of the total cost.

The system is assumed to work at a constant current of 250 amp. at varying voltages up to 2 × 110,000, and the current would be delivered from two banks of eight series-generator sets, each set having two 7,000-volt armatures. At the receiving end two similar banks of motors would be used, although these would be installed in different parts of Denmark. The motors would be directly connected to synchronous generators, which would convert the power to three-phase, and this would be stepped up to 50,000 volts for further distribution. The mid-point of the generator and motor systems would be solidly grounded, so that each 110,000-volt side could operate with a ground return in case of trouble on the other side. The current would be kept at 250 amp. by means of high-speed brush-shifting regulators, and by similar devices the speed of the high-tension motors

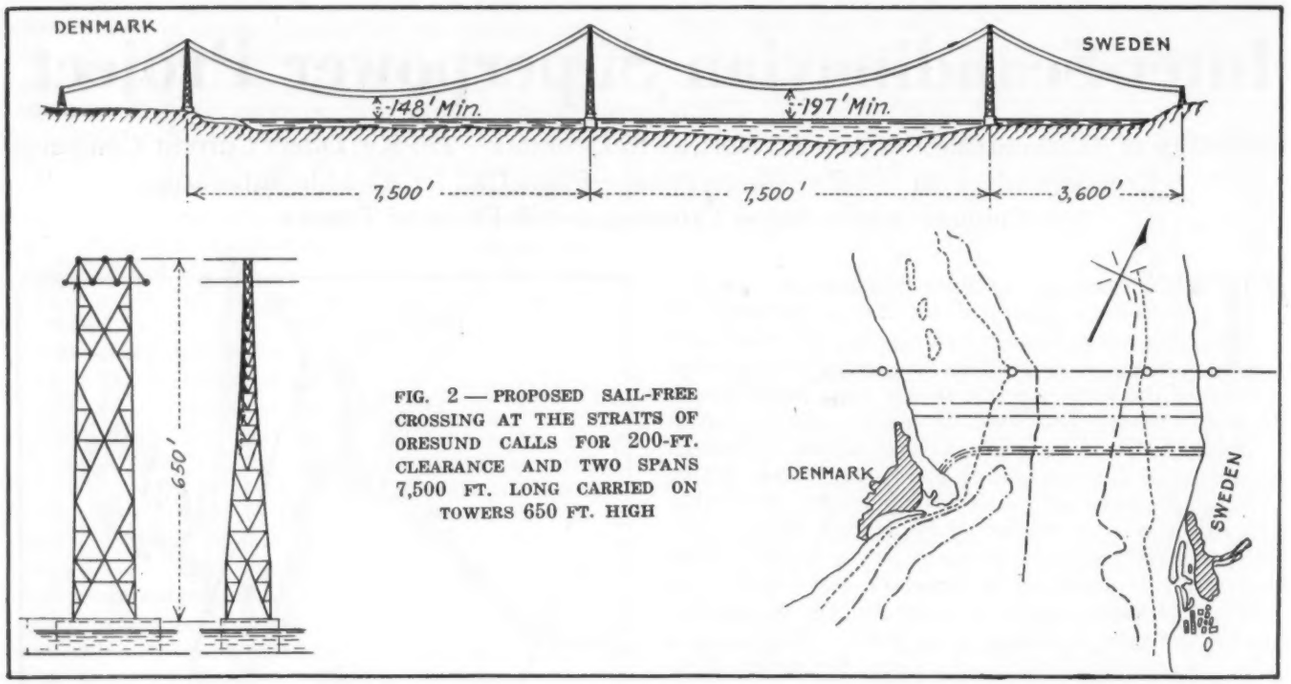


FIG. 2 — PROPOSED SAIL-FREE CROSSING AT THE STRAITS OF ORESUND CALLS FOR 200-FT. CLEARANCE AND TWO SPANS 7,500 FT. LONG CARRIED ON TOWERS 650 FT. HIGH

would be regulated to correspond to a fixed frequency on the three-phase side.

If three-phase transmission were used from Norway to Denmark, a 132,000-volt line would be erected along the Swedish coast down to Helsingborg, on the Straits of Oresund. Since at present cables cannot be operated safely above 50,000 volts, it would be necessary to step down to this voltage before crossing to Denmark. In that case very expensive synchronous-condenser stations would be needed to insure good voltage regulation on the Danish system, and this would limit the economic transmission capacity of the system to about 50,000 kw.

Proposed Overhead Crossing

An alternate scheme therefore has been worked out, calling for an aërial crossing 200 ft. high as a minimum over the Straits. Two spans would be needed, each 7,500 ft. long and carried on 650-ft. high steel towers. The conductors would be 240 sq.mm. (475,000 circ.mil) extra-high-quality steel, surrounded by 110-sq.mm. (217,000-circ.mil) aluminum. The cost of the towers was estimated at $320,000 each, including foundations, consisting of concrete caissons 200 ft. x 100 ft. x 53 ft.

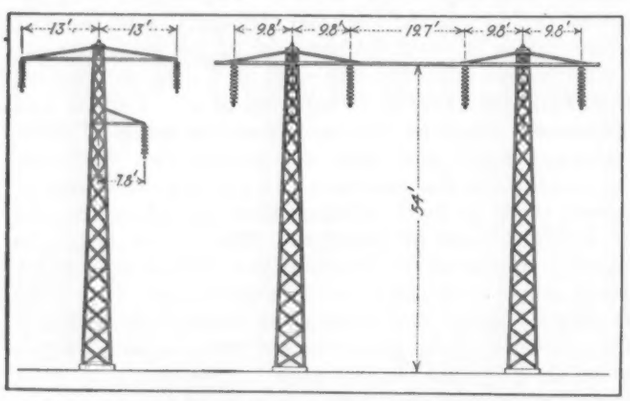


FIG. 3—A SINGLE TOWER WITH THREE 132,000-VOLT CONDUCTORS IS FIRST STAGE OF DEVELOPMENT

With two towers, three live and one reserve conductors for 220,000 volts may be used. The last stage comprises three towers with a 95-ft. crossbeam and two 220,000-volt three-phase circuits.

The total cost of the crossing would be approximately $850,000.

Hydro-electric energy from the Nore falls in Norway, which are now being developed, could be directly transmitted at 132,000 volts over a 400-mile line to Copenhagen, and by increasing the voltage to 220,000 about 105,000 kw. could be economically transmitted per circuit. With such a possibility in mind, the commission recommends the use of the type of transmission towers shown in Fig. 3. At first only one leg would be erected, as shown at the left, and three or four (one reserve) conductors would be used. In the next stage one more tower would be built and the line converted to four-wire, 220,000-volt. Finally a third tower would be added, and six 220,000-volt conductors employed. This type of tower has been chosen for certain other 132,000-volt trunk lines already built in Sweden. The horizontal arrangement of the conductors offers advantages such as facilitating work on the reserve conductor when the line is alive and minimizing contact hazards due to sleet and rain.

400-Mile Transmission Line

Using this type of construction and providing ample mechanical and electrical safety factors, the cost of a 3 × 120 sq.mm. (3 × 236,000 circ.mil) copper line for 132,000 volts is estimated at $8,800 a mile, and a four-wire 400-sq.mm. aluminum + 90-sq.mm. steel (790,000 circ.mil aluminum + 178,000-circ.mil steel) line insulated for 220,000 volts would cost about $20,000 per mile, based on 1922 market conditions.

Cents, Not Dollars

IN THE article entitled "What It Means to Change from Overhead to Underground," on page 856 of the Electrical World, issue of Oct. 27, cents, not dollars, should be the unit of cost for the duct foot units given in the first ten items at the top of the page in the right hand column. Also, in the three line summary of costs in the same table, "Per Manhole" applies to the first item only.

Drying Transformers—II

Best Equipment to Use in Drying—Methods for Tanking Transformer After Drying—Limitations of Treatment and Precautions to Be Used in Field Work

By M. E. SKINNER
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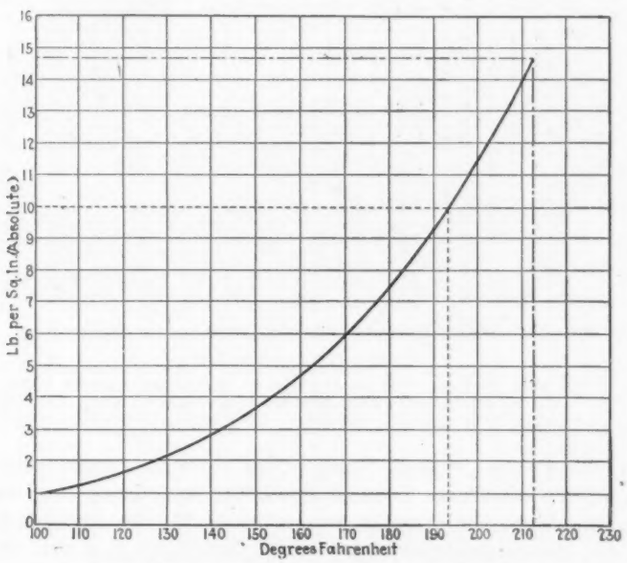
THE fundamental idea of the method of drying advocated in this article is to circulate about 500 cu.ft. of heated air per minute through the ducts of each transformer which is being dried. The proper amount depends upon the size of the unit and, of course, upon whether it is single-phase or three-phase. A 2,000-cu.ft.-per-minute blower should be amply sufficient to take care of drying a bank of three large-capacity units at one time.

With the relatively slow air velocity through the ducts of the transformer the pressure required to force the air through the windings will be low, probably less than ½ oz. per square inch. In fact, the pressure to be supplied by the blower will be determined largely by the drop through the heater, the screens and passages rather than that through the transformer itself. If the piping is of large cross-section and the area of the inlet screen is large, the total pressure may be less than 1 oz. per square inch. However, in many cases this would hardly be sufficient, so it is recommended that the blower be capable of delivering its volume against a pressure of at least 1½ oz. per square inch. Any excess pressure available in the blower can be absorbed by increasing the thickness of cheesecloth over the blower intake or by throttling down the ducts leading to the transformer by means of dampers.

In general, a constant-speed motor will be desirable. Belt drive is more flexible than any other type as it permits the use of various motor speeds without changing anything except the pulley ratio. For a blower, which will deliver 2,000 cu.ft. of air per minute against a pressure of 1½ oz., the power requirements should not exceed 3 hp. In applying the motor it should be kept in mind that either increasing the blower speed or decreasing the back pressure against which it is working will tend to overload the driving motor.

Heaters employing almost any kind of fuel, coal, oil, gas or electricity, may be used, although the latter has many advantages over the first three, any of which will require more or less constant attention and even when carefully watched will result in considerable variations in the temperature of the heated air. Another disadvantage of these heating agents is the fact that the heat must be applied indirectly in order to avoid the injurious effects of the products of combustion on the insulation of the transformer. Of the various types of electrical heating elements, the common cast-grid frame is probably best suited to this work. This construction is extremely rugged, is most readily obtained and can be restacked when necessary to change the value of the resistance. Such a resistance element will also stand, without burning out, the very high temperatures which would result if the air supply should fail for any reason. It is also very well adapted for boxing in so that all the air passes through the active section of the heater.

The control in its simplest elements would consist of switches for the motor and heater circuits. For small motors a safety switch with thermal cut-outs is very convenient. As motors of the size which will be employed may usually be thrown directly on the line, it is not necessary to provide an under-voltage release. A knife switch will do for the heater circuit, but is not adapted for opening the circuit automatically in case of excessive temperatures in the grid chamber due to a failure of the air supply. This can most conveniently be arranged by the use of a circuit-breaker equipment with a low-voltage release and a small bake-oven thermostat. The thermostat is normally open but closes on excessive temperatures, short-circuiting the undervoltage release coil and opening the breaker.



CORRESPONDING TEMPERATURES AND PRESSURES AT WHICH BOILING TAKES PLACE

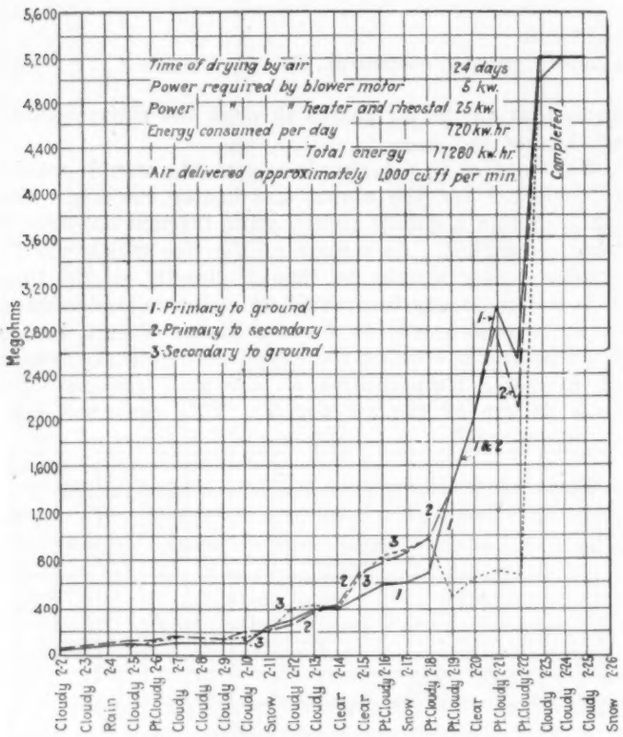
Any source of electrical energy of the proper voltage may be used to circulate current in the windings during the drying period. Alternating current will be found most convenient, for one winding may be short-circuited and the current circulated in both by impressing the necessary voltage across the other winding. If direct current were used, it would generally be necessary to use two sources of supply regulated independently of each other, one for each winding, and the voltage would be inconveniently low on one winding and probably high on the other.

The voltage V to be impressed upon the windings depends upon the impedance of the transformer and the

frequency employed. Z, the impedance of the transformer in ohms, may be obtained from the name-plate data as follows:

Let P = per cent impedance of the transformer (given on the name plate),
I = rated full-load current of either winding,
E = normal voltage of that winding,

then, $P = ZI/E \times 100$, or $Z = P/100 \times E/I$, or



TYPICAL CHART OF INCREASE IN INSULATION RESISTANCE DURING DRYING PROCESS

This was obtained without the use of circulating current. Drying could no doubt have been hastened by supplementing the hot-air heating with a small amount of heat from circulated current.

$I = P/100 \times E/Z$. Since the resistance component of the impedance is very small, the impedance may be considered as directly proportional to the frequency for all practical purposes. From the above it is evident that if a voltage $= P \times E/100$, called the impedance volts, is impressed across one winding, full-load current will flow. To reduce the current the voltage should be reduced in proportion.

As an example take the case of a 10,000-kva., single-phase, 60-cycle transformer for stepping down 110,000 volts to 22,000 volts and having 10 per cent impedance. The full-load current would be 10,000/22 kv. = 454 amp. on the low-voltage side.

$Z = 10/100 \times 22{,}000/454 = 5.0$ ohms at 60 cycles,
$= 2.08$ ohms at 25 cycles.

Twenty-two hundred volts, 60 cycles, impressed on the low-voltage winding would give full-load current, as likewise would 11,000 volts, 60 cycles, impressed on the high-voltage winding. To get one-tenth of full-load current these values should be reduced to 220 volts, 60 cycles, and 1,100 volts respectively. The corresponding figures for one-tenth full-load current at 25 cycles would be 91.6 volts and 457 volts respectively.

The value of current to be circulated depends largely upon local conditions. In general, it will be found to lie between one-fifth and one-tenth of normal full-load current. Its value should be adjusted to maintain a temperature at the inlet to the transformer of not over 90 deg. C. as measured by thermometer.

Opinions will always differ as to the details for handling any piece of work such as the drying of large transformers, but there are a few things in connection with the preparations which will always make for the success and rapidity of the undertaking. First might be mentioned precautions against loss of heat from radiation. These would include, first, shortening up the air ducts between the heater and the transformer as much as possible and, second, lagging the tanks and piping. As mentioned heretofore, a boiler-iron tank 6 ft. in diameter and 12 ft. high will radiate about 7 kw. with a temperature difference of 40 deg. C. between the tank and the outside air. This may be very materially reduced by wrapping tarpaulins loosely about the tank.

It is, of course, absolutely essential to take every precaution against the entrance of dirt into the transformer. Cheesecloth screens should be kept over the blower intake at all times. This cheesecloth should be renewed as frequently as necessary, and it will be found that soaking the cheesecloth with oil will greatly increase its effectiveness in filtering dirt and dust out of the air entering the blower.

With the method of drying suggested it is possible to put all bushings and fittings in place and complete the connections before the drying is begun. Openings in the tank, such as those through which the cooling-oil connections enter, are frequently made oil-tight by the use of a stuffing gland or gasket. Where this material will shrink or crack when dried out it may be necessary to protect such openings from the effects of the heated air. Otherwise they are liable to leak after the tank has been filled with oil.

Sufficient oil to fill the transformers completely should be properly conditioned, ready for use as soon as the drying shall have been completed. Where the oil has been shipped in drums samples from each should be tested to insure that every drum is in good condition. Whenever the oil fails to meet the standard test of 22,000 volts between 1-in. disks, separated 0.1 in., it should be filtered.

MEASUREMENTS TO BE TAKEN

Insulation resistance measurements to determine the condition of the insulation and temperature measurements to insure that the transformer is not heated dangerously must be taken periodically.

The insulation resistance should be measured from the high-voltage winding to the low-voltage winding, to the core, and from the low-voltage winding to the core. While the insulation resistance of a transformer is the best criterion we have of the dryness of a transformer, it is affected very markedly by a large number of factors besides moisture. It varies with the size and voltage of the transformer, with the form of construction, with the temperature, the fluid in which the transformer is immersed (air or oil), and finally with the moisture content. Being subject to the effect of all of these variables, it is almost impossible to predict what the proper insulation resistance for a given transformer should be. We know that the larger the physical dimensions of the unit and the lower the voltage class the lower the insulation resistance will be; that if the transformer is of the shell form of construction the insulation resistance will be lower than if it is of the core form; that it will be lower after the

transformer is filled with oil than before this is done, and finally that the higher the temperature the lower will be the insulation resistance. However, no one has been able to evaluate all of these factors quantitatively.

It is the practice of transformer manufacturers to measure the insulation resistance on the completion of the vacuum drying and oil impregnation at the factory and prior to the application of disruptive dielectric tests. This figure should be representative of an entirely satisfactory condition of dryness in the insulation and may be used to judge when the insulation resistance has reached its proper value. In making comparisons against this figure it is essential that all other conditions shall be comparable. This is especially true of the temperature, as the insulation resistance is very sensitive to changes in this factor. A transformer in which the insulation is dangerously wet may show a very high insulation resistance when cold.

The most reliable way of judging from insulation-resistance measurements when a transformer is dry enough to tank is to plot daily readings of resistances, all taken at the same temperature. When the insulation rises to a high value and remains steady for two or three days the transformer will be dry enough to tank. The final value of insulation resistance should compare reasonably well with the factory test. In case of a wide discrepancy some other factor other than moisture may be affecting the results.

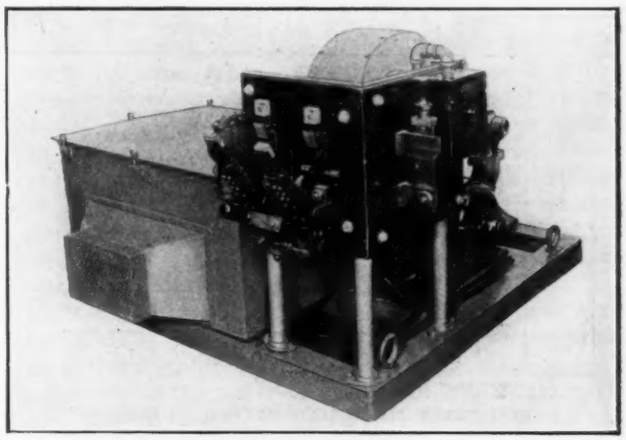
The most satisfactory way of measuring insulation resistance is by means of a megger. In case a megger is not available a high-resistance voltmeter may be used with a source of direct current, as shown in the illustration on page 968.

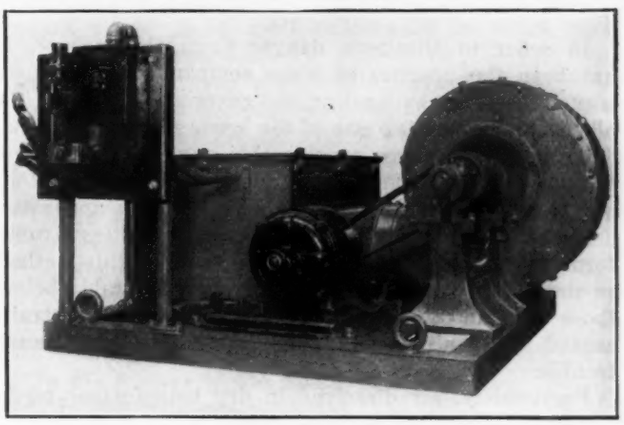
A very careful check on the maximum temperature of the insulation should be maintained throughout the progress of the drying period. If overheated, there is great danger of a fire from spontaneous combustion. It is important to keep in mind always that you are working with a large mass of oil-soaked, inflammable material and to treat it accordingly. A liberal number of thermometers should be placed in the windings. The temperature should also be checked daily from the resistance of the windings. In judging the temperature of the hottest spot from the thermometer and resistance measurements it is important to remember that the hottest air is entering at the bottom at the opposite end of the transformer from where the thermometers are located.

The hottest temperature of the insulation should not be allowed to exceed 105 deg. C. Taking into account the inability to reach the hottest spot with a thermometer, it will probably be advisable to keep the indication of the hottest thermometer below 90 deg. C.

It is important that the transformer be watched constantly during the drying period as the danger of fire is always present and the success of the method depends upon the maintenance of steady temperatures as close to the limit as is consistent with safety. A chart of the periodic readings of insulation resistance and temperatures will be found very useful in following the progress of the drying. Readings of insulation resistance should be taken at least once daily and preferably twice a day. Temperature readings should be taken as frequently as is deemed consistent with safety.

Sometimes transformers exhibit very peculiar performance during the drying period. Such freakish behavior can almost always be traced to some cause which, although it may be obscure at first, will very readily explain the difficulty once it has been located. A simple test which will frequently disclose difficulties of this nature is to take a cooling curve of the insulation resistance. As has been stated previously, the insulation resistance is extremely sensitive to changes in temperature, and as the transformer cools





TWO VIEWS OF A DRYING OUTFIT

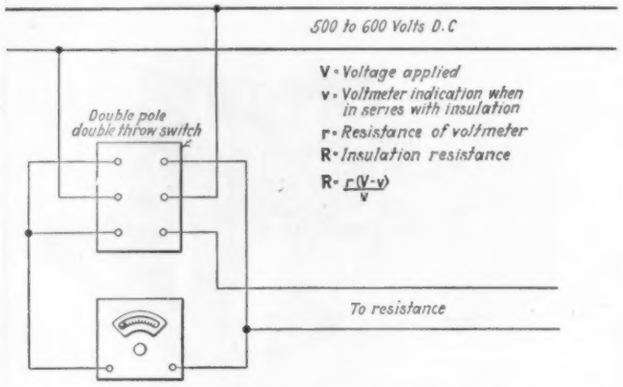
The apparatus has been mounted on a small angle-iron framework and is entirely self-contained. It has sufficient capacity to handle a bank of three transformers as large as have been constructed up to the present time and will probably be ample to take care of considerable growth in the size of power transformers.

down the insulation resistance should increase materially. Any other behavior should immediately be followed up by a thorough investigation to determine the source of the difficulty. Sometimes moisture will be driven from one part of the insulation into another portion with an accompanying increase in the insulation resistance. Unless this moisture is completely removed from the transformer, however, as soon as the temperature falls the moisture will redistribute and leave the transformer in a dangerous condition. Such cases can be very quickly detected by means of a cooling curve like that referred to above. It is recommended that such a curve be taken in every case toward the conclusion of the drying period.

TANKING THE TRANSFORMER

After the insulation-resistance measurements indicate that the transformer has reached a satisfactory condition the transformer should be tanked without delay. Speed is desirable for two main reasons—first, to prevent the insulation again taking up moisture and, second, to set up a circulation of the oil which will dislodge air bubbles which may have got into the transformer as it was being filled with oil. Air

bubbles are a very real source of danger in an oil-immersed transformer as a local discharge starting in such a bubble may spread until it develops into a complete breakdown. The higher the voltage of the unit the more important it is to see that all air bubbles have been removed before voltage is placed upon it.


500 to 600 Volts D.C
V = Voltage applied
v = Voltmeter indication when in series with insulation
r = Resistance of voltmeter
R = Insulation resistance
R = r(V-v)/v
Double pole double throw switch
To resistance

RESISTANCE MEASURING METHOD TO USE IN ABSENCE OF MEGGER

In order to eliminate danger from this source, it has been the practice of some companies to fill their transformers by exhausting the cases and allowing the oil to flow in through one of the lower pipe connections. This method requires considerable auxiliary apparatus to maintain the partial vacuum, and there is some question whether its expense is justified on apparatus designed for commercial circuits. For testing transformers there is more to be said in favor of this method as the factors of safety are reduced considerably below those used on commercial apparatus and an overstrain caused by an air bubble is much more liable to cause trouble.

Fortunately, air dissolved in dry transformer oil is quite effervescent, and even when agitated violently the bubbles rise with surprising rapidity. If ordinary care is used and the hose through which the transformer is filled is directed against the side of the tank very few bubbles will remain in the oil as it gradually rises over the core and windings. If the tank is filled while the transformer is still hot, a good healthy circulation of oil will be maintained until the heat stored in the core and windings has been absorbed by the oil. This will be found very effective in driving out any air bubbles that have lodged in the windings and insulation.

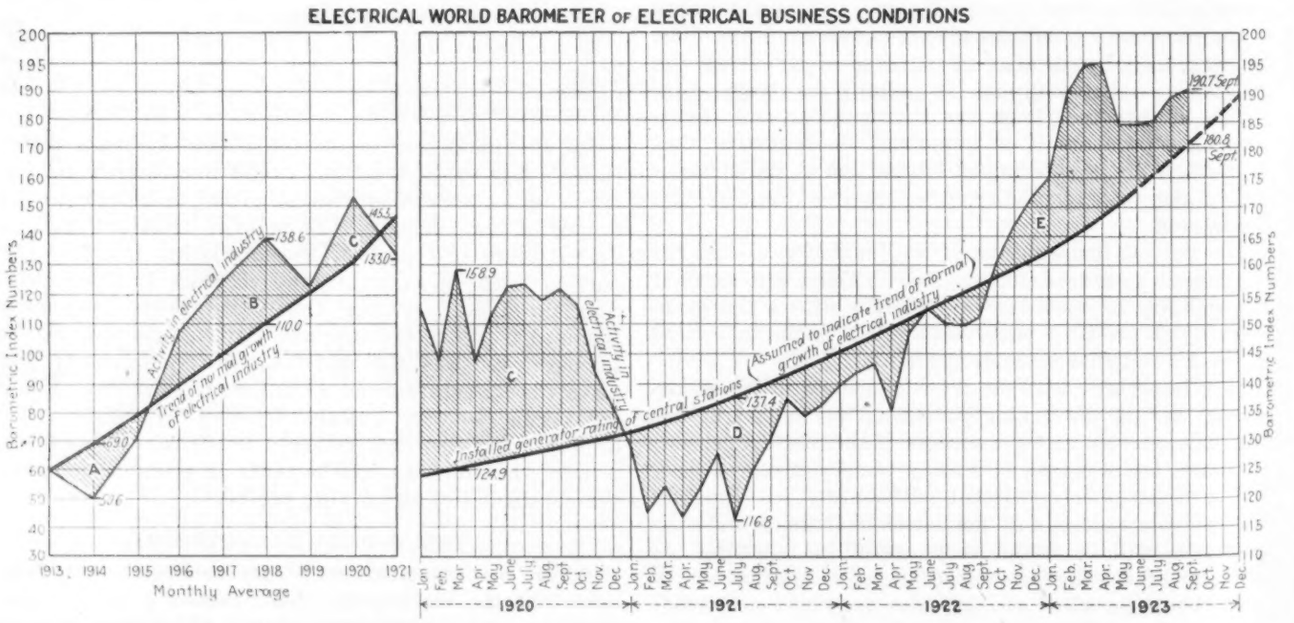
If it is at all possible, voltage should be applied to the transformer very slowly when it is energized for the first time. This hardly needs further comment, as it is the natural thing to do in the case of any piece of apparatus on first putting it into service.

Fall Activities 9.9 per Cent Above Normal

INDEX figures upon which the "ELECTRICAL WORLD Barometer of Business Conditions in the Electrical Industry" is based indicate that activity in a very large portion of the primary industries of the country was further curtailed during September. Of the primary industries used as a basis for the "ELECTRICAL WORLD Barometer" only three showed increased activity during September over August, that is when referred to their respective normal growths.

Economic authorities agree that general business conditions this fall remain sound. Distribution, as indicated by the record car loadings, has been active, while stocks have not been reported as excessive. These conditions, taken in conjunction with the large purchasing power of consumers throughout the country at the present time, presage fall trade on a high plane.

The data upon which the "ELECTRICAL WORLD Barometer" is based indicate an increase of 1.4 points on the barometer scale as compared with August activities. During this interval the industry has grown 3.0 points, leaving a net increase in activity of 1.6 points on the barometer scale as compared with August. The electrical industry as a whole was operating in September at 9.9 points or per cent above what would have been the point of seasonal demand if growth in the industry had been normal. In August it was operating at 11.3 and in July at 9.3 points or per cent above the point of normal demand.



Letters from Our Readers

A Place Set Apart for Suggestions, Comments and Criticisms, to Which All Men of the Electrical Industry Are Cordially Invited to Contribute

Use of By-Product Power from Steel Plants

To the Editors of the ELECTRICAL WORLD:

I am much interested in the article by L. B. Breedlove on utilization of by-product power from steel plants.

In the production of steel as well as in the production of many other commodities a very considerable element of by-product heat or material which will produce such heat is treated. As far as such heat or material can be used by the manufacturer or by others it should be made use of. Its employment certainly conserves our natural resources in either coal or gas or some other form of fuel and conserves them in a practical way.

The proper position for the central-station company to take, as the writer sees it, is that we should like to furnish these manufacturers with such additional power as they may need over that which they can develop by their by-product heat, which additional power must be developed from raw coal or other fuel.

We believe that the properly organized central power company can furnish such additional power, all things considered, more cheaply and more reliably than the steel mills or other manufacturers can furnish it.

The company with which I am connected will be very glad to enter into negotiations with any of the large steel companies in our territory with the view of furnishing such excess power as they may require over the amount of power which they can produce from waste heat and, at times when the waste heat exceeds their requirements, of absorbing all surplus energy available at any one point. This might be done in two ways:

First, additional energy as required could be supplied to the steel manufacturer on the basis of proper schedules, and in the event of excess surplus by-product power such surplus by-product power could be purchased outright at the point of production. This surplus would have to be bought manifestly at a very low rate—at the best slightly lower than the cost of production in the central power company's power plant. Manifestly this is essential as all of the investment necessary in production machinery, transmitting and distributing lines, etc., would have to be carried whether this surplus power were purchased or not. The power thus purchased and other power would then be sold at remote points of consumption under the company's regular schedule. At first thought one might feel that the steel manufacturer's surplus by-product power should be bought by the central power company at a price substantially equal to the price at which power was sold to the manufacturer by the central power company, but financial considerations make this impossible.

The second method would be to arrange to transmit all surplus by-product power over the company's lines from the point of production to the point of consumption, charging for this service a sufficient amount to carry a just proportion of the cost, maintenance and obsolescence on the line together with a reasonable margin for profit, in which case if the consuming point or points absorbed more power than the producing plant delivered, the excess power would be sold to the consumer under some definite schedule.

Another and the real point of interest in such an interconnection program, however, is the investment saving through interconnection. This investment saving may arise in different ways in different localities. For instance, it may be that the diversity in load between that carried by the central power company and that carried by the manufacturer producing waste-heat by-product may be such that even the central power company may have less apparatus to install to serve its other trade. In other cases, and I think in the majority of cases, the conservation of investment would be for the steel company or such other company as was producing by-product heat. For instance, if the by-product heat plant were to operate independently of any outside sources and 10,000 kw. were its maximum normal requirement, the proper installation would probably be decided on as three 5,000-kw. units, allowing one of the units as a spare. On the other hand, if the plant were to be linked to an outside source of power and were to purchase power in excess of the by-product heat, capacity of one 10,000-kw. unit alone would be necessary as the power reserve could then be taken from the central power company. Such 10,000-kw. unit should not only operate more economically than two 5,000-kw. units but could be installed for about one-half the cost of three 5,000-kw. units.

There are many places today where the steel mills employ high-class engineers in charge of their power plants. In such plants there is no reason why it should not be practicable to operate the power units of the steel mills in parallel with those of the central station, either directly or through frequency changers, as the adopted types of apparatus might require. It is also possible to meter such operation.

C. S. COOK,
Duquesne Light Company, Pittsburgh, Pa. Vice-President.

Deplores Refusal of Test to "Romex"

To the Editors of the ELECTRICAL WORLD:

It was with regret that I read in the "News of the Industry" in your number of Oct. 20 the article indicating that the National Fire Prevention Association had rejected a field test of the new wiring material, "Romex." The electrical business in this country was not built up in this way, and I think it deplorable that any such committee should have the authority to refuse a reasonable trial of any material unless it is perfectly obvious that such material would constitute a hazard that no one in the business would want to approve. The sooner the manufacturers and fire underwriters realize that wiring costs have passed the reasonable point, the better. Some of the rules have reached the point where they become absurd, and some of the men who are responsible for the formulation of rules in different localities are forming some rules that in my judgment are not defensible.

I do not believe the central-station industry is sufficiently aroused to the seriousness of this situation, and the sooner it does become interested to the extent of insisting on an examination of the rules of self-appointed bodies outside of the most important branch of the electrical industry, the better for all of us. I believe tests of new material can be made by disinterested electrical bodies or engineering institutions equipped with the proper staff and facilities for making unbiased reports on such new material, and that such tests, reports and decisions should not be left in the hands of interested parties as I believe they are today.

Chicago, Ill. E. W. LLOYD.

Central Station and Industrial Practice

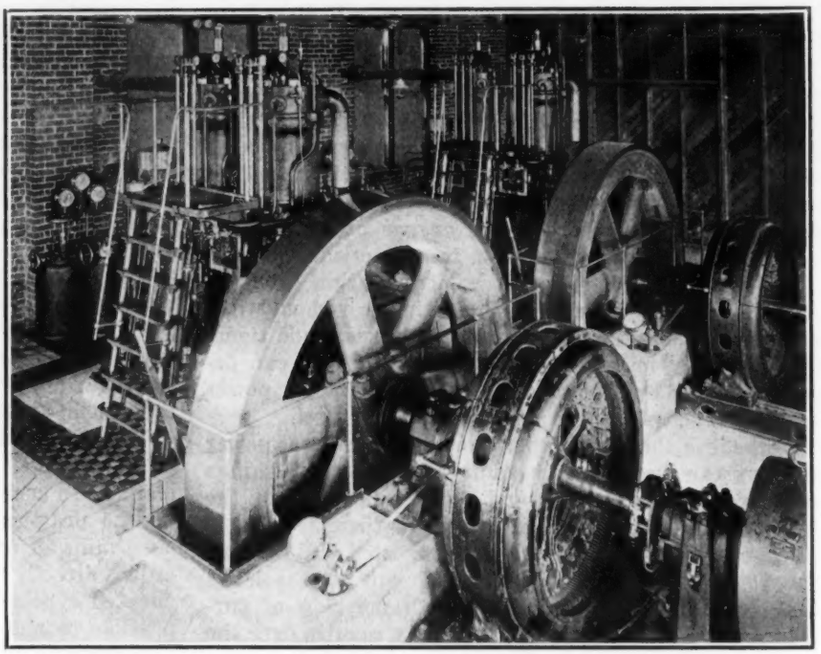
Installation, Operation, Maintenance, Test and Repair of Generation and Distribution Equipment, and Methods of Economically Utilizing Electric Service in Large Industrial Plants

The Economical Operation of Diesel Engines

By C. Mendelsohn

Mechanical Superintendent Old Dominion Company, Globe, Ariz.

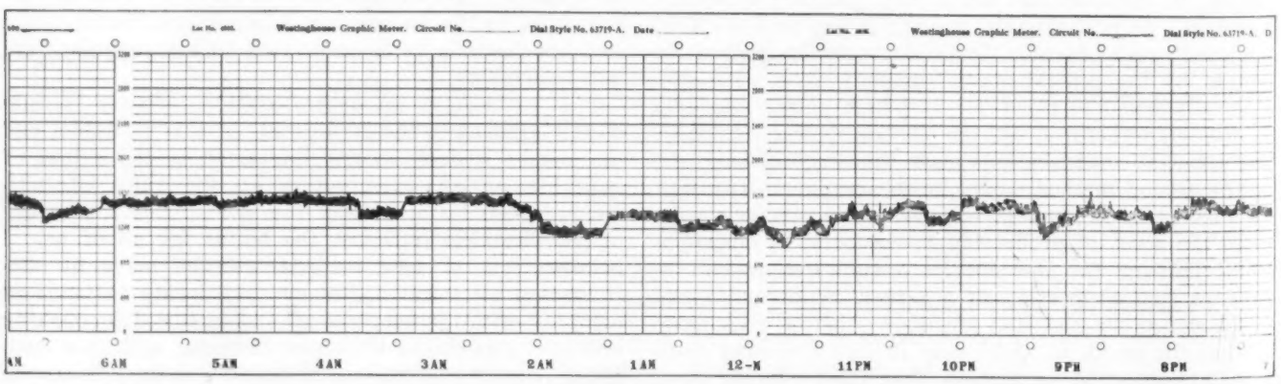
VERY satisfactory results have been obtained from a Diesel-engine generating plant of two units in Arizona belonging to the Old Dominion Company. One unit, shown in the foreground of the accompanying illustration, was installed in February, 1918, while the other was installed May, 1921. The two engines are identical except for the fuel pumps and some minor details. The exciter is directly connected to the older unit and chain-driven by the other. Each unit comprises a vertical five-cylinder, two-stroke-cycle Nordberg-Carels-Diesel engine with a directly connected 850-kva., 2,300-volt, three-phase, 60-cycle alternating-current generator. Each engine is rated at 1,250 brake-hp. at sea level, or approximately 1,000 brake-hp. at the elevation of the plant, which is 3,700 ft. above sea level. The operating crew consists of an engineer and an oiler on each of three eight-hour shifts and a chief engineer directly in charge of the plant. The repair work is done by men sent in from the shops when an engine is down.



AVERAGE FUEL-OIL CONSUMPTION OF ONE BARREL FOR 425 KW.-HR. IS RECORD OF THIS PLANT

Under normal operating conditions there is sufficient load to keep both engines running twenty-four hours per day and every day in the week, and the engines are shut down only for repairs or inspection. For twelve months to June 1, 1923, the total time lost this way amounted to 1,673 engine-hours, or an average of 836.5 hours per engine, which is 9.5 per cent of the total elapsed time. For the last several years the load, figuring power generated at the switchboard against actual running time, has averaged 605 kw. per engine. A typical load curve is shown herewith. Fuel consumption has averaged one barrel for 425 kw.-hr. generated at the switchboard. This compares with a rate of 170 kw.-hr. per barrel for a 750-kw. turbine at the company's steam plant. The engines are running on Mexican fuel oil of about 15 deg. Baumé gravity, except that light oil of about 27 deg. Baumé gravity is used for starting.

The consumption of lubricating oil averages about 3.6 gal. per twenty-four engine-hours. Softened make-up water is used for the circulating system at a cost of about 0.01 cent per kilowatt-hour. Miscellaneous operating supplies cost about 0.012



LOAD CURVE OF 1,500-KW. DIESEL-ENGINE PLANT IS EXTREMELY EVEN OVER THE ENTIRE TWENTY-FOUR HOURS

cent per kilowatt-hour. Of the kilowatt-hours generated at the switchboard, about 1.9 per cent is used for power-plant lights and for circulating the cooling water. The rest of the power that is generated is available for distribution.

The cost of maintenance and repairs has varied over a wide range, decreasing from year to year, owing to the additional experience gained by everyone connected with the operation and upkeep of the engines. It would seem that for this plant, with conditions as at present, 0.21 cent per kilowatt-hour would be a fair average cost for maintenance and repairs over a series of years.

About six months after the new engine was installed it made a continuous run of seventy-eight days, which is a record for these engines. During this run the average load was 610 kw., with fuel consumption at the rate of one barrel of oil for 450 kw.-hr. at the switchboard. The record output for twenty-four hours was made by the older engine about three years after it was installed and soon after the power cylinder liners had been replaced. This output amounted to 20,520 kw.-hr. at the switchboard, or an average load for the twenty-four hours of 855 kw.

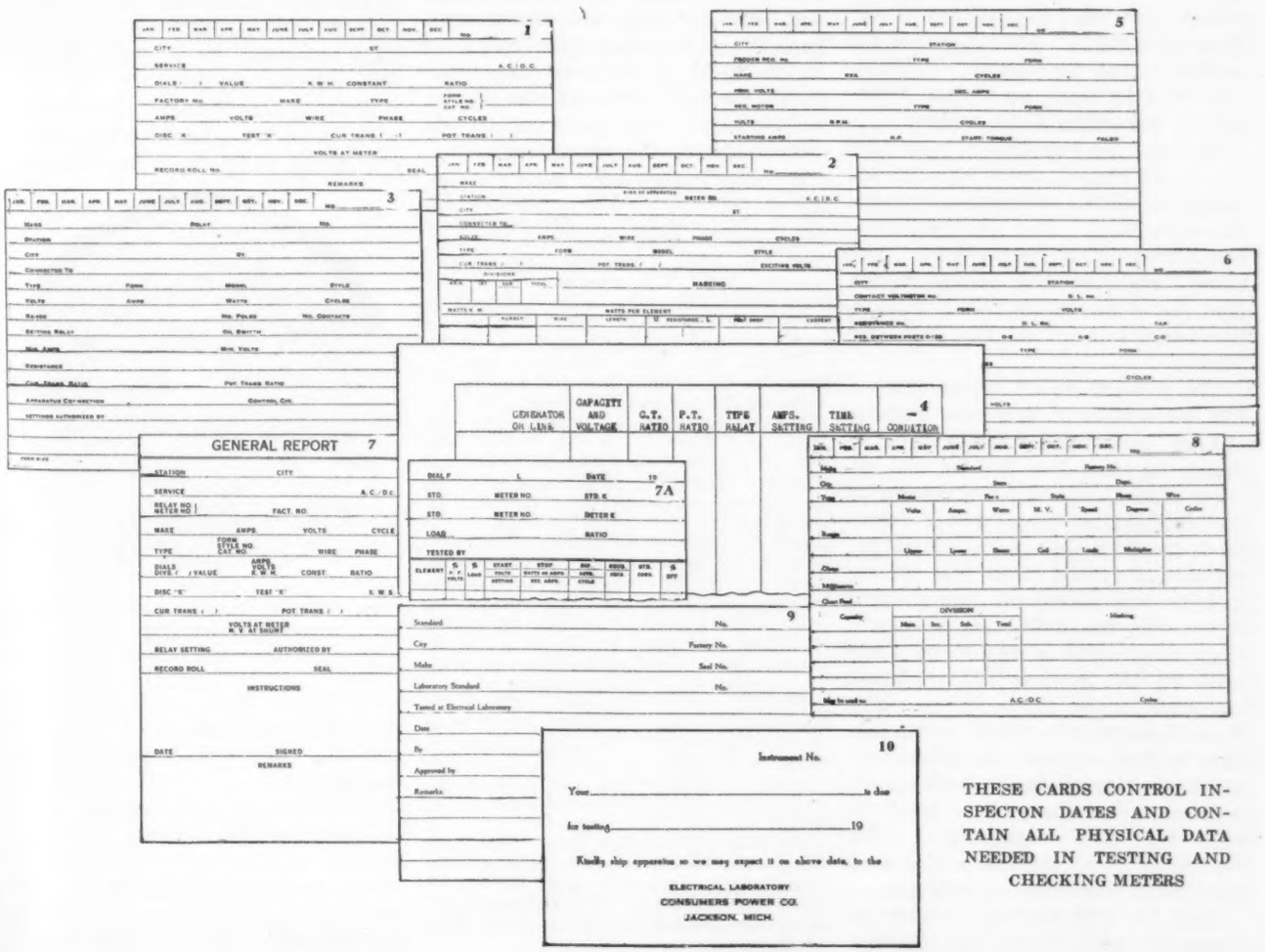
These record runs merely show what it is possible for these engines to do. In ordinary operation it has been found that the best results are obtained when each engine is shut down at least once every fourteen days for inspection and repairs and the maximum peak load does not exceed 800 kw. per engine.

Improving Regularity of Meter Testing

System Used by the Consumers' Power Company, Which Has Proved Very Satisfactory for the Past Five Years, Described in Detail

BY JAMES KELLY
Superintendent Electrical Laboratory,
Consumers' Power Company, Jackson, Mich.

THE card-filing system for handling all meter maintenance and testing in the fourteen districts of the Consumers' Power Company, Jackson, Mich., gives at a glance the condition of every meter on the company's lines. This system consists of colored 4-in. x 6-in. cards for various meter types which are housed in a twenty-five-drawer filing cabinet at the electrical laboratory in Jackson. At the top of each card is printed the month of the year. This is done so that colored metal clips may be mounted directly upon these cards to indicate when the meter must again be inspected. These clips are also given different colors to designate the various time intervals between testing. After a meter is tested these clips are then moved ahead a period which varies with the type of the meter; for instance, a billing meter reading receives a check every three months, while for primary meters one check per year has been found sufficient. By these clips a direct check can be made on all work which requires immediate attention.



THESE CARDS CONTROL INSPECTON DATES AND CONTAIN ALL PHYSICAL DATA NEEDED IN TESTING AND CHECKING METERS

Each card also contains space for the meter number, the maker's name, the location of the meter and all other information necessary in making an accurate check of that particular meter. The bottom of the card contains room for any other additional data characteristic of the meter. The range of inspections may be taken from the illustrated number of cards. The card No. 1 covers both the permanent and the graphic watt-hour meters. In filing, this card is placed in the particular division in which the meter or instrument is installed. Card No. 2 is for the permanent station instrument-type meter covering a full description of station instruments. This card is also filed under its particular station in the division wherein it is installed.

RELAY RECORDS IMPORTANT

For relays, card No. 3 is used, which has spacings for all necessary data needed on any one relay. On the back of this card are spaces for the date of last test and for any remarks. It is filed in the same manner as the two cards mentioned above. Card No. 4 is a loose-leaf record covering the most recent settings of a relay. Several copies are made so that the division superintendent may have up-to-date information regarding their relays.

The voltage regulators have card No. 5, which has space allotted for recording all the necessary regulator characteristics. For the regulator auxiliaries, such as contactor voltmeters and line drop compensators, card No. 6 was made. It is filed in the same manner as the first two cards.

The general report, which gives a full description of watt-hour meters, station instruments and relays, is shown on card No. 7. On the reverse side (No. 7-A) the results of the calibrating tests are entered. Each month's data taken from the permanent record cards due for inspection are placed on this general report for the field men to check. They then enter a report of their tests on the reverse side. Should any changes be made in the field, these changes are entered in red ink. This is done so that the laboratory will know that the permanent record card must be changed to conform with the new conditions. This method of using red ink is also used upon meter removals or settings.

Card No. 8 is for the portable instruments and covers a full description of all portable instruments in all territories. Rotating test and portable meters are given card No. 9. On the back of this card are spaces for noting tests "As Found" and "As Left." Cards are made out in duplicate so one record always follows the meter, while a record also remains in the laboratory.

When the time arrives for a new inspection as indicated by the colored clips, a postcard No. 10 is mailed to the meter location notifying the person responsible for the various instruments that they are due in the electrical laboratory for testing by a certain date. After testing, they are expressed back to their original location and then followed up by a letter inclosing a copy of the express receipt and a card covering the tests performed. These data cards are filed in that district, thereby giving a complete performance record of all the instruments on the system.

Steel-Flange Standards for High Pressures Planned

A COMPREHENSIVE program of standardization of steel flanges and flanged fittings was inaugurated Oct. 26 by sub-committee No. 3 of the A. S. M. E. sectional committee on the standardization of pipe flanges and fittings. The following actions were taken by the committee:

Range of Pressures for Steel Flanges.—The maximum steam pressures for which these standard flanges and flange fittings shall be developed are 250, 400, 600, 900, 1,350, 2,000 and 3,200 lb. per square inch. The maximum temperature which they are to be designed to withstand was set at 750 deg. F.

250-Lb. and 400-Lb. Steam Standards.—These two steel standards are to have the same bolt circle and number of bolts as the present American cast-iron standard for 250 lb., except that the 2-in. and 2½-in. sizes for the 400-lb. standard will have eight bolts instead of four. The other dimensions of these flanges are, however, to be modified to meet the conditions set for each.

600-Lb. Steam Standard.—The subcommittee further decided to use as the basis of the dimensions of this standard the bolt circle and the number of bolts of the present 800-lb. hydraulic standard developed by the A. S. M. E. committee. (See *Transactions of A. S. M. E.*, Vol. 40, 1918, page 501.)

900-Lb. Steam Standard.—The basis for this new steam standard flange is to be the bolt circle and the number of bolts of the present 1,200-lb. hydraulic standard developed by the A. S. M. E. committee. (See *Transactions of A. S. M. E.*, Vol. 40, 1918, page 501.)

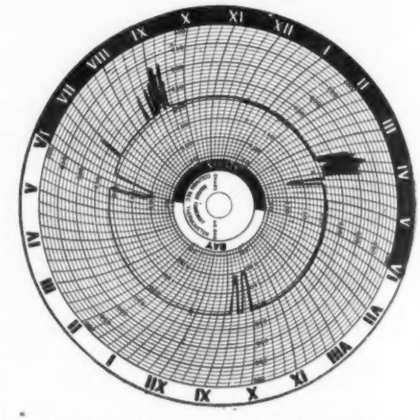
Standards for 1,350, 2,000 and 3,200 Lb. Steam Pressures.—Flanges to withstand these pressures and the corresponding superheats are to be developed after the completion of the first four of the series.

Blow-Off Periods Recorded by Thermometer

BY FREDERICK L. RAY
Superintendent Power Plants, Union Traction Company of Indiana, Anderson, Ind.

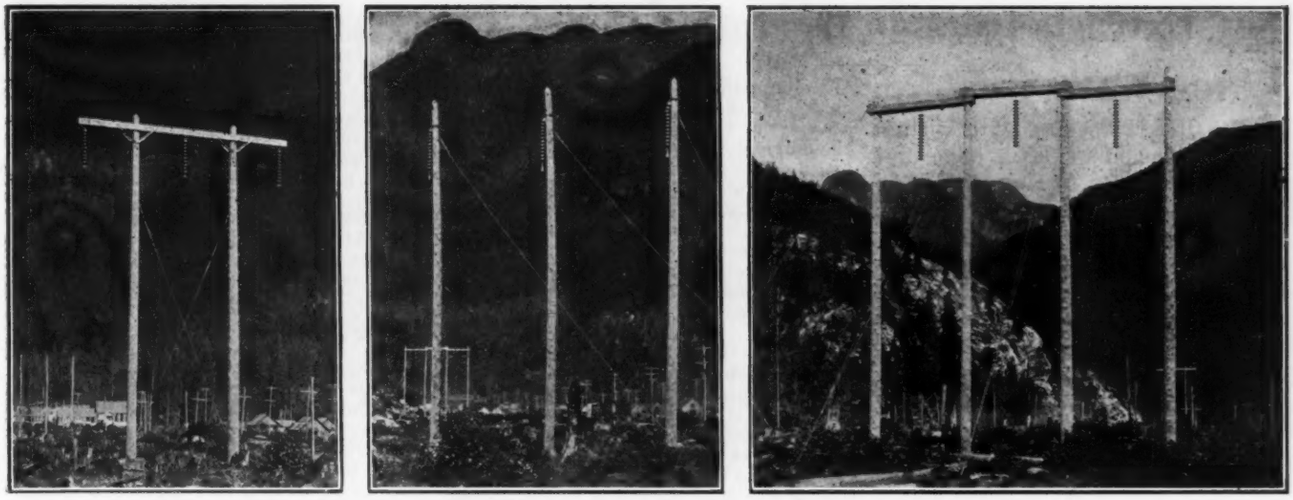
IN BOILER-ROOM operation often the hardest thing for the chief engineer to keep track of is the systematic "blowing down" of boilers. Except by asking the firemen on the various shifts, he has no way of knowing when this operation was performed or how long it took. To obtain an accurate, permanent check on it the Union Traction Company of Indiana, Anderson, Ind., installed a recording thermometer in the blow-off header. The blow-off valves from the sixteen boilers were connected to a main header discharging into the blow-off header. At the extreme end of this header was placed the thermometer element of a remote-reading instrument. The leads were then run up to the main turbine floor, where the indicating unit was placed on a panelboard, directly behind the boilers. As this was a new boiler installation, the panelboard was enlarged so that two flue-gas-recording pyrometers could be mounted adjacent to the recording thermometer. This recording thermometer for the blow-off line cost $64.50.

A temperature chart, shown herewith, taken from the blow-off recording meter, shows a continuous ring



AN INSTANT VISIBLE CHECK OF ALL BOILERS BLOWN DOWN GIVEN BY THIS CHART

at a temperature of 212 deg. F., with the exception of the blow-off periods. The reason for this ring can be explained by stating that with sixteen blow-off valves enough steam is continuously leaking into the header to establish an atmospheric steam condition of 212 deg. F. The periods of blow-off can be easily determined by the increases in tem-



THREE TYPES OF TOWERS USED ON THE 165,000-VOLT SKAGIT RIVER TRANSMISSION LINE

perature at 9 p.m. and 4 a.m.—these being the regular schedules for blowing down. The number of peaks indicates how many boilers were put through that operation.

Wooden-Pole Construction Used on 165-Kv. Line

A HUNDRED-MILE single-circuit transmission line to operate at 165,000 volts is now under construction to bring the power from the Skagit River hydro-electric development of the city of Seattle into the city for distribution. The line will be built entirely of untreated native cedar poles on a 150-ft. right-of-way. The towers are of the H-type, consisting of two poles with timber cross-arms at the top. The three conventional types of towers are shown in the accompanying photographs. The normal length of span is 600 ft. with a minimum ground clearance of 30 ft.

The conductors will be 300,000-circ.mil copper-equivalent, steel-core aluminum, and the line will have a capacity of 90,000 kva. Ten suspension insulator units will be used on the straight suspension towers, twelve units on the angle towers and fourteen units on the dead-end towers. The angle towers consist of three poles and the dead-end towers of four poles, with cross-arms at the top.

The line is being built under contract by an electrical construction firm of Seattle and will be completed by the end of the year. The towers are assembled on the ground with the exception of the insulator strings, and raised in one operation.

Distribution Material Costs in New England

FROM the cost sheets of a New England central-station company come the accompanying material expenses incurred in 1922 from January to December inclusive in connection with the installation of 2,462 services. The total labor expense was $23,072, or slightly under $10 per service. Repetitions in the list are due to the purchase of supplies at different periods during the year.

COST OF SHORT-LINE EXTENSION MATERIAL FOR 2,462 SERVICES INSTALLED

	Number of Units	Price per Unit	Total
30-ft. chestnut poles	220	$10.62	$2,334.62
35-ft. chestnut poles	204	14.88	3,036.03
40-ft. chestnut poles	100	17.25	1,725.47
45-ft. chestnut poles	3	16.30	48.90
No. 6 rubber-covered wire, ft.	2,000	.04	80.60
No. 2-0 wire (weatherproof), ft.	1,097	.082	90.06
No. 4-0 wire (weatherproof), ft.	7,170	.142	1,015.99
No. 2 wire (weatherproof), ft.	24,594	.043	1,079.68
No. 6 wire (weatherproof), ft.	528,258	.017	9,350.17
Outrigger arms	159	1.802	286.61
Ten-pin cross-arms	6	2.706	16.24
Six-pin cross-arms	1,815	1.766	3,206.38
Four-pin cross-arms	143	1.373	196.45
No. 8 two-conductor service cable, ft.	5,535	.04	221.95
No. 8 three-conductor service cable, ft.	78,004	.0815	6,357.33
No. 10 two-conductor service cable, ft.	71,814	.053	3,806.14
No. 6 three-conductor service cable, ft.	2,103	.138	290.95
Insulators, guy wire, strain clamps, etc., for 2,462 services	.....	.49	1,265.99
30-amp. 600-volt, three-pole switch	1	.....	2.94
200-amp., 250-volt, three-pole switch	1	.....	7.95
Three-pole slip couplings	2	.34	.68
Three-pole close nipples	2	.16	.32
Three-pole check nuts	2	.08	.16
Three-pole bushings	2	.495	.99
¾-in. LB fittings and blank cover	1	.45	.45
¾-in. bushings	4	.035	.14
No. 6 rubber-covered wire, ft.	40	.037	1.48
No. 8 wire, ft.	40	.028	1.12
1-in. conduit, ft.	4	.67	2.68
30-amp., 600-volt, three-pole fused switch	1	.....	2.94
30-amp., 600-volt fuses	3	.20	.60
No. 8 rubber-covered wire, ft.	21	.02	.42
60-amp., 250-volt switch	1	.....	1.50
30-amp., 600-volt, three-pole switch	1	.....	4.23
10-in. by 17-in. switch boxes	2	4.34	8.68
Double duct box	1	.....	3.82
No. 6 rubber-covered wire, ft.	16	.03	.48
No. 8 rubber-covered wire, ft.	12	.02	.24
200-amp., 250-volt, three-pole switch	1	.....	7.95
30-amp., 600-volt, three-pole switch	1	.....	4.23
3-in. slip couplings	2	.34	.68
One 1¼-in. LB fittings and blank cover	1	.....	1.16
One ¾-in. conduit, ft.	1	.....	.23
No. 6 rubber-covered wire, ft.	20	.03	.60
¾-in. conduit, ft.	118	.10	11.80
Ground clamps	12	.12	1.44
LB fittings	.....	.....	.56
Locknuts and bushings	.....	.....	1.77
¾-in. shields	8	.147	1.18
¾-in. weather cap	.....	.....	.59
¾-in. LB condulets and b covers	2	.095	.19
¾-in. conduit, ft.	16	.086	1.37
¾-in. LB condulets and b covers	3	.45	1.36
¾-in. weather caps	3	.41	1.23
No. 10 rubber-covered wire, ft.	425	.01	4.25
No. 14 rubber-covered wire, ft.	540	.006	3.24
Two-wire No. 14 BX, ft.	200	.058	11.60
¾-in. loom, ft.	250	.02	5.00
¾-in. BX connectors	16	.118	1.87
¾-in. pipe clips, lb.	1	.....	.15
¾-in. pipe clips, lb.	12	.01	.12
Iron brackets	8	.14	1.12
Glass insulators	8	.12	.96
No. 1935 cut-outs	6	.15	.90
30-amp. three-wire switch	1	.....	1.57
12-in. x 16-in. x 4-in. steel box	1	.....	2.64
10-amp. fuse plugs	12	.....	.36
Ground rod and clamps	.....	.....	.42
Ceiling plates	10	.10	1.00
"Nail-it" knobs	113	.025	2.83
3-in. tubes	17	.....	.27
Window cord, ft.	8	.02	.16
Weatherproof key socket	1	.....	.34
Weatherproof pigtail socket	.....	.....	.39
Miscellaneous small items	.....	.....	1.05
Dry cells	13	.35	4.55

Note—Other items on this work included: Location orders, $490.67; freight on material, $157.40; teaming material, $91.09; company transportation, $3,756.12; labor, $23,072.89; additional material, $30.98; fee, $30, and one-half cost of poles set by telephone company, $2,186.37.

Extracts from an Operating Code*

High-Tension Testing

BEFORE proceeding with certain high-tension tests it is important to make tests for foreign voltage as in the case of low-tension testing, because the preparation for these tests requires direct handling of the high-voltage conductor by the operator. The following tests were given in last week's issue besides the description and general operation of the testing equipment: Line insulation and ground test, line phase test, transformer insulation and ground test and transformer phase test. Several other tests are outlined below:

Insulation and Ground Test for Generators and Synchronous and Induction Motors, Using Test Set

1. Remove the motor from the stator.
2. Connect the machine leads to a separate bus and line.
3. Apply the line insulation and ground test.
4. Disconnect the machine leads from the separate bus and line.

Insulation and Phase Test on Synchronous and Induction Motors and Rotary Converters, Using Separate Engine

First Method (applied generally to small machines):

1. Throw the starting switch of the machine to the running position.
2. Connect the machine by means of a separate bus and line to an alternator operating at normal speed but with no field.
3. Cut in all resistance in the alternator-field rheostat.
4. Close the field switch.
5. Increase the voltage of the alternator to the normal value at the rate specified by the load dispatcher.
6. Carefully observe the machine being tested to note any insulation defects and also that the rotation is in the proper direction.
7. After a short period of operation in this manner, shut down the machine being tested and allow it to come to rest.
8. With the supply voltage at the normal value, whether fed from the separate engine or from the system, throw the starting switch to the starting position and note that the machine again starts in the proper direction and comes up to the normal starting speed.
9. If the machine starts in the proper direction and comes up to the normal starting speed, proceed with the operations of starting until the starting switch has been thrown to the running position satisfactorily.
10. Shut down the machines.

Second Method (applied generally to large machines):

1. Throw the starting switch of the machine to the running position.
2. Connect the machine by means of a separate bus and line to an alternator operating at normal speed and one-half voltage.
3. Immediately on connecting the machine to the separate alternator, increase the voltage of the alternator to the normal value at the rate specified by the load dispatcher.
4. Carefully observe the machine being tested and note any insulation defects and also that the rotation is in the proper direction.
5. After a short period of operation in this manner, shut down the machine being tested and allow it to come to rest.
6. With the supply voltage at the normal value, whether fed from the separate engine or from the system, throw the starting switch to the starting position and note that the machine again starts in the proper direction and comes up to the normal starting speed.
7. If the machine starts in the proper direction and comes up to the normal starting speed, proceed with the operations of starting until the starting switch has been thrown to the running position satisfactorily.
8. Shut down the machines.

Phase Test on Alternators and Direct-Current-Started Synchronous-Motor Generators

1. Connect the machine to a separate bus and line extending to the synchronizing station.
2. Start the machine and bring it up to the synchronous speed.
3. At the synchronizing station connect the synchroscope and synchronizing lamps between the line and bus and synchronize.
4. Test the synchronizing devices and connections in the station in which the machine that is being synchronized is installed. If the connections are correct, the synchroscope should read zero and the lamps be dark.
5. Remove the cover from the face of the synchroscope, move the pointer off zero and put in the synchronizing plug; the pointer should move back to zero if the connections are correct.
6. Disconnect the machine from the separate bus and, after the line has been energized from the generating station, synchronize the machine against the bus.

Circuit Insulation and Ground Test

1. Energize the circuit from a separate bus and transformer, noting that the ground detectors are connected to this bus.
2. Observe the ground detectors.

Circuit Phase Test

First Method:

1. Have the main station light and power transformer bank connected to the main bus and the auxiliary station light and power transformer bank to the auxiliary bus.
2. Energize the circuit to be tested from a separate bus and transformer and connect it to the auxiliary bus.
3. Using a voltmeter of suitable scale or two 125-volt test lamps in series, check both the main and auxiliary clips of the station light and power secondary double-throw switch for voltage by testing across clips on the same side.
4. If voltage is indicated on both the main and auxiliary clips, test across in turn from each clip on one side to the corresponding clip on the other side.
5. Correct phase relation is indicated by zero voltage between each clip on one side and the corresponding clip on the other side.
6. Transfer a circuit of proper phase to the same bus to which the circuit to be tested is connected.
7. Parallel the circuit to be tested and the circuit of proper phase through the auxiliary bus. Paralleling is the final check on the phase relation of the circuit.
8. Cut apart the circuits.
9. After both the above tests show correct phase relation, check the regulator motor and control apparatus for proper direction of rotation.

Second Method:

1. Connect the circuit to be tested to a separate low-tension bus and through a separate transformer, high-tension bus and line to the synchronizing station.
2. Block in the main oil switch and block the regulator control of the circuit to be tested, and also of a circuit in synchronism with the bus against which the circuit is to be synchonized.
3. Energize the circuit to be tested through the auxiliary bus from the circuit of correct phase.
4. At the synchronizing station connect the synchroscope and synchronizing lamps between the bus and the line. Proper phase relation is indicated by a zero reading on the synchroscope and by the lamps' remaining dark.
5. Disconnect the circuit to be tested and the circuit of proper phase from the auxiliary bus.
6. Remove the blocks from the main oil switches and the regulator controls.
7. Energize the circuit to be tested from a separate low-tension but through a separate transformer.
8. Transfer a circuit of proper phase to the same low-tension bus.
9. Parallel the circuit to be tested and the circuit of proper phase through the auxiliary bus. Paralleling is the final check on the phase relation of the circuit.
10. Cut apart the circuits.
11. After both the above tests show correct phase relation, check the regulator motor and control apparatus for proper direction of rotation.

Circuit Phase Test on Entire Circuit

1. Connect the circuit to be tested, outside the station, to a circuit in synchronism with the bus against which the circuit is to be synchronized. This circuit may or may not originate in the same station as the circuit to be tested. This connection is generally made by the transmission and distribution department at breakdown boxes.
2. Block in the main oil switch of the circuit of correct phase.
3. Connect the circuit to be tested to a separate low-tension bus and through a separate transformer, high-tension bus and line to the synchronizing station.
4. At the synchronizing station connect the synchroscope and synchronizing lamps between the bus and the line. Proper phase relation is indicated by a zero reading on the synchroscope and by the synchronizing lamps remaining dark.
5. If the circuit to be tested is not to be left on after the test, open its main oil switch, disconnecting it from the separate bus.
6. Disconnect the circuit to be tested from the circuit of correct phase.
7. Remove the block from the main oil switch of the circuit of correct phase.

*Abstracted from the operating code of the Philadelphia Electric Company.

Central Station Business

Advertising, Selling and Service Methods
Commercial Organization and Management, Customer and Trade Relations, Public and Financial Policies, and Reports of Company Plans and Experiences

Merchandising Policies and Results at Providence*

Growth of Appliance Business Has Necessitated Establishment of Eleven Electric Shops by Central Station —Gross Sales Exceed Half Million Dollars Annually

By Arthur B. Lisle
General Manager Narragansett Electric Lighting Company, Providence, R. I.

EVERY central-station executive whom I know believes it would be entirely unnecessary to do any merchandising, and much better, if there were available contractor-dealers or electrical merchandisers of any sort who were capable, had the capital and were willing to push the business as it should be pushed, thus enabling the utilities to confine their efforts to generating and selling kilowatt-hours. Every executive must decide for himself, however, what his local conditions are; but so far as the Narragansett territory is concerned no one but ourselves would put the effort into merchandising that we have and at the same time give the service and attempt to enhance the good will of the community. The figures given below are significant in this connection.

Original Electric Shop Location Retained

We started in the merchandising business a good many years ago with one electric shop. Soon it grew so that we took the store next door and increased our space. In a few suburban towns like Warren and East Greenwich we had arrangements with local druggists by which they acted as our agents, collecting bills, exchanging lamps and reporting complaints, but experience showed this to be a side issue with them. The public was not taken care of as it should have been, so we decided to establish our own shops, in every case much to the benefit of ourselves and the public.

A few years ago the question arose as to the advisability of moving our electric shop from its office building location to the center of the retail trade district, giving us enlarged space and a great increase in rent. It was decided that it would be better to keep the electric shop where it was and to establish branches in the outlying districts. There are now

ARTHUR B. LISLE

two shops in Providence proper, and we are planning at least three more. Including our subsidiary companies, we now have eleven electric shops, and in nearly every town we have no trouble or complaints from the electric contractors. We endeavor so far as possible to co-operate with them in every way.

We maintain prices fixed by the manufacturers, and when we have special sales we give the contractor-dealers an opportunity to join in, even so far as to offer campaign stock to them, agreeing to take it back at the end of the sale if there is any left. We take a prominent part in the Rhode Island Electrical League and do our part in the establishment of electrical homes.

We encourage the department stores to handle electrical goods and, outside of trivial misunderstandings once in a while, work in harmony with them.

We spend about $20,000 a year in newspaper advertising and use illuminated billboards, as well as mail circularization with bills and without them. We make a very strong effort to dress our windows attractively. Practically all the time of one man is spent in going from store to store designing and changing window displays.

Whenever it is possible, the plan is followed of having something moving, such as a pump in operation, fans, motors, trick devices, a woman using a flatiron, ironing machine, washer or demonstrating some cooking device. An expert advertising agency is employed to handle the company's activities in the display field, this concern making a special study of such problems as a part of its business. As much of our merchandise appeals to women, this advertising house has a woman on its staff who studies sales and application problems from a woman's viewpoint. This is felt to be of great advantage to the company.

Sales Are $18 a Year per Customer

In the seven electric shops of the Narragansett company proper there was merchandised during the first half of 1922 $81,000 worth of incandescent lamps and $138,000 worth of appliances, a total of $219,000, and in the corresponding six months of 1923 the company sold $89,000 worth of incandescent lamps and $238,000 worth of appliances, a total of $327,000, or an increase of 49 per cent. This is at an average rate of $18 per customer per year.

The electric shops are run as a department by themselves under the management of A. H. Allcott, who is responsible for them and is entitled to the credit for their success. Against this department are charged

*From an address delivered before the New England Division, N. E. L. A., at Swampscott, Mass., Sept. 5-8.

the rent for the shops, the salaries of all employees, all incidental expense, all delivery expense, bookkeeping, storehouse, uncollectible accounts, merchandise adjustments, insurance, taxes and interest on the investment. If any reduction in the price of incandescent lamps or apparatus of any kind occurs, the loss is charged to the account of this merchandise. The gross sales in 1922 totaled $569,000 and included 4,284 flat-irons, 4,768 portable lamps, 2,214 vacuum cleaners, 464 washing machines and fifty-two electric ranges, besides many other appliances.

In November, 1922, the company started a campaign on vacuum cleaners, advertising in the newspapers and by a broadside which offered $3 for an old broom or carpet sweeper in part payment for the cleaner, for cash or on time payments, $1 down and 75 cents per week. In one month the company sold 1,152 cleaners for $66,572, or one every thirteen minutes of a ten-hour day.

A broadside was sent to residential customers on the mailing list advertising the value of electrical appliances as Christmas gifts, and this was followed by newspaper advertising. The result was a gross business during the twenty-one-day Christmas season of $122,000, which exceeded that of the previous year by 37 per cent. Last April we had a washing-machine campaign, selling the machines at $115 each and with each offering as a premium a clothes drier, step ladder and box of soap chips. The resulting sales totaled 188 machines for $22,300. Despite the sale of 1,152 cleaners in November last 1,125 more were sold this year, the feature of this campaign being a table lamp as a premium. Eight hundred of these cleaners were sold over the counter without the aid of outside salesmen. In a single flatiron campaign now drawing to a close we expect to sell two thousand irons. In this campaign small broadsides were sent to forty thousand customers.

Favorable Outlook for Profit in Electric Shops

We cannot say after the charges of a zealous auditor are all in that we have made money in this merchandising department, but when some of the local conditions improve we shall make money in this business. The estimated income from the apparatus sold in 1922 was $109,000 per year.

The best policy for a central-station company is to hire an expert merchandiser, back him up with moral support, capital and inspiration, and let him furnish the perspiration. This leads to results beyond one's fondest hopes.

To Help the Farmer Move His Wheat

CENTRAL-STATION companies have often been of material assistance in promoting the commercial and civic welfare of the communities they serve. The above window shows how the Nebraska Power Company in Omaha did its part in the national movement launched to aid the farmers by encouraging the purchase and use of more wheat and flour.

What a Public Utility Should Advertise

An Advertising Man's Criticism of Some of the "Copy" Used in Good-Will Publicity

BY ROBERT S. MERRILL

"THEY ought to have their rates cut," declared an advertising man recently when he was looking over a series of advertisements which the local central-station company had been running in an attempt to explain its problems to the lay public. "Some electric light companies can do the most asinine publicity work I ever saw," he went on.

"They use space and talk about the 'magic of electricity' and that sort of bunk until they get lots of people to believe that their sole investment is in a wizard's wand and a push-button on the wall. Surely there is something that can give people a picture of substantial buildings and interesting equipment.

"You know people like to read about interesting machinery—look at the magazines of the popular mechanical and scientific type and the circulations they have. Of course, they are written so almost anybody can understand them. So why not somethink like that about electric light plants?"

He was right; the public can be interested in the workings of the plant itself. For instance, the Grand Junction (Col.) Electric, Gas & Manufacturing Company used paid advertising headed "The Rainmaker" to explain some of its equipment. It read:

So many have asked us the function of the "rainmaker" at our electric plant at Fifth and South Avenue that we believe it of general interest.

This equipment constitutes what is known as a spray pond. Its sole function is to cool the water coming down from the steam condensers on our steam turbines. After being cooled, the water is pumped back through the condensers and is used over and over again. The steam condensers are box-like affairs filled with small copper tubes. The steam strikes one end of the tubes, the cool water the other, condensing the steam and forming the vacuum under which the turbines work, thereby greatly increasing their efficiency.

Every one seems to think that this spray pond is in some way used for making ice. It has no connection with the ice plant.

The spray pond takes the place of the old high cooling towers which have recently been wrecked and removed. The pond is much more efficient and dependable, requires less power for pumping and far less attention.

The "rainmaker" is one more step toward modernizing the plants which furnish the citizens of Grand Junction with electrical energy and artificial ice.

There are many things of interest in the plants that furnish Grand Junction with utility service. Have you ever been through these plants? We shall be glad to furnish you with a guide who will explain the modern equipment operating in these plants. Let us know when it is convenient to inspect them.

Now, here is a company that realizes that its plant contains many things of interest. It extends an invitation to the public to visit it and offers to furnish guides. There are always, in any city or town, persons who will accept such invitations. But more will not because a startling number have just enough timidity to dread first experiences. Some of them really do not see what right they have to impose upon anybody's time.

For such persons—and they are the far greater number—why not take the plant to them through the newspapers?

GET THE LAYMAN'S VIEWPOINT

In short, get somebody to tell in type and illustrate with pictures the interesting things about your plant. Be sure that it is written so that a child can understand it. Be sure that it is pictured as the public would want to see it—not what interests an electric light man. That's why it would be a good idea to get an outsider to do it; electric light men are generally too close to their work to see things as others see them.

A series of articles that would picture the light plant as an interesting place also would make it apparent that there was a big investment in equipment and distributing systems. Any person intelligent enough to be interested in the equipment will be aware that it cost considerable money to install it.

Therefore don't insult them by making it appear that the series was run for the purpose of putting over an increase in rates or something. Don't give them any cause to wonder why the electric light company is spending all that money.

If they read an interesting description of some part of an electrical system, that alone will absorb them. They will begin to feel acquainted with the company; the company will represent something more tangible than a magician's wand. Then when it has any pleading to do, if ever, more persons will be ready to lend a sympathetic hearing.

Should there be pictures in such a series? Judge for yourself, but did you ever hear anybody remark, "Gee! that's a little machine to cost that much." Why not impress people by telling what a thing does rather than by its size? Many more persons are able to understand action described in words than the number who can understand a picture of a machine. To grasp the idea from the picture one must be mechanically minded. One of the leading popular science magazines insists upon having a human being in each picture, because a picture of a machine standing alone seldom means anything to the average reader.

The advertisement, "Bulbs and the Plant You Don't See," which the Western Electric Company ran some time ago in the interest of the electrical industry is a good example of drawing a picture so the public will understand it. It began: "Here's a curious reversal of nature. Bulbs in plain view, but the plant out of sight—and too often out of mind." It spoke of the "miles of distributing mains which connect the house with the generating station where there is the equipment of stokers, boilers and generators and where there are men on the job night and day to keep that equipment in order." The advertisement closed with: "But don't ignore the plant altogether. Neglect has stunted many a one, and if it stunts this, your service and the whole community will suffer. The electric light plant, like every other, needs nourishment—and what it thrives on best is your good will."

FORGET ELECTRICITY'S MAGIC

If the plant thrives on good will then the best thing is for the public and the plant to get better acquainted. Tell the public about "the rainmaker" (use names that will stick in their minds) or anything else rather than harp on the idea of the "magic." The "magic" idea is a pleasing day dream, but buildings and machines make rates understandable.

What Other Companies Are Doing

Texas.—Six salesmen of the Texas Power & Light Company sold more than a thousand kitchen lighting units during eighteen days' work in Temple and Taylor, two of the district towns served by the company. The campaign was launched in Taylor, and at the end of the first day's work all doubt as to the success of the campaign was dispelled. Each of the six salesmen reported back in the evening with more orders than had been expected for the first week.

Boston, Mass.—Twenty thousand new customers have been added to the Edison Electric Illuminating Company's books during the past year, and a total of 166,000 customers is now served in the 650 square miles of territory reached by the system. Peak loads this fall are passing all previous records. About half the houses in company territory are still unwired. Since Jan. 1, 1923, about 80,000 kw. in new business has been added to the company's lines, the bogey for the year being 100,000.

Oklahoma City, Okla. — On the theory that any institution that increases the wealth of the state is a public benefactor and that to discourage the sending of money out of the state is to add to the state's wealth, the Oklahoma Gas & Electric Company has developed a campaign for keeping public utility dividends at home. Two teams of sixty-five each have been organized among the company's Oklahoma City employees to compete for thirty days ending Nov. 30 in the placing of the company's preferred stock. The winning team is to be entertained by the company at a dinner-dance at the close of the contest.

Springfield, Ill. — The Illinois Power Company has taken a group life and disability policy covering its employees. The company pays the entire cost. The life insurance varies from $500 for employees in service one year to $1,500 for those in service eleven years or longer.

Ladysmith, Wis.—The Lake Superior District Power Company is in the midst of an extensive washing-machine campaign to place an electric washing machine in every home in this city and the nearby town of Bruce. So far the campaign has been highly successful. Orders have been taken for a carload of electric washers. At the county fairs held in Ladysmith and Ashland this company established booths labeled "wife-saving stations" designed to stimulate the sales of electric appliances and the installation of electricity in homes. Besides appliances, charts were displayed to the public at these fairs, showing the growth of the company and the location and extent of its properties in Wisconsin. Merchandise sales of the company for one week in September amounted to $4,262.

Digest of Electrical Literature

Including Brief Abstracts of and References to
Important Articles Appearing in the Scientific and Engineering Press
from All Parts of the World

Hydro-Electric Development and Steam Equipment

The Paradox of Hydro-Steam.—G. H. MOORE.—A very complete analysis is given, showing that energy generated by combined steam and hydro-electric prime movers costs less than when generated by either one separately. The author presents the essential elements which dictate the economic proportionment of hydro-electric and steam electric generating-plant capacity. Data on a 32,000-kw. hydro plant, a 32,000-kw. steam plant and on 32,000-kw. plus 18,000-kw. hydro-steam plants show that in one particular instance the annual cost per kilowatt-hour with a 50 per cent load factor would be $0.0055, $0.0096 and $0.0051 respectively.—*Engineering News-Record*, Aug. 30, 1923.

Insulation in Power Plants.—L. B. MCMILLAN.—The author gives the simplest and cheapest method of recovering and preventing avoidable heat losses in the power plant. In tabular form are given the heat losses from uninsulated hot surfaces, total radiation areas of standard flanges, data on commercial pipe coverings and losses that occur through flange unions by radiation.—*Blast Furnace and Steel Plant*, August, 1923.

Surface Condensers.—J. M. DRABELLE.—Turbines are now being so designed as to make use of lower absolute pressure than ever before, thereby placing on the condensing apparatus requirements that a comparatively few years ago were not even heard of. In this article the author discusses surface condensers and the factors that govern obtaining and maintaining low absolute pressures. The requirements of a well-laid-out condenser installation are also outlined.—*Sibley Journal of Engineering*, October, 1923.

Generation, Control, Switching and Protection

Pellet Type of Oxide-Film Lightning Arrester.—N. A. LOUGEE.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. summer convention, July 7, 1923, page 20.—*Journal of A. I. E. E.*, October, 1923.

Deformation of Traveling Electric Waves.—S. A. STIGANT.—In order to minimize the effects of the transients resulting from switching operations, arcing ground and atmospheric lightning discharges various forms of lightning-arrester gear are in use, most of which embody the characteristics of inductance and capacity. The manner in which inductance and capacity act in deforming the initial shapes of transient waves is dealt with. For this purpose two circuits of the same surge impedance are considered, a series choke coil being inserted at the junction between the two circuits in one case and a condenser being shunted from the junction of the two circuits to earth in the other.—*Electrical Review* (*England*), Sept. 21, 1923.

Transmission, Substations and Distribution

Overhead Transmission Lines.—Four reports of the British Electrical and Allied Industries Research Association on different types of conductors for overhead lines are given. These reports cover (1) hard-drawn copper wires and cables, (2) hard-drawn aluminum wires and cables, (3) galvanized-steel wires and cables, (4) steel-cored aluminum cables. Scope of the investigations, a description of the materials under test, the range of the samples tested, mechanical and electrical tests, etc., are considered for each type of wire.—*Institution of Electrical Engineers* (*England*), September, 1923.

Insulation Design of Anchors and Tower Supports for 110,000-Volt, 4,427-Ft. Span Over Carquinez Straits.—L. J. CORBETT.—The methods by which some of the problems were solved, the hinged anchor structure, the sturdy insulated support for the towers, the movable top for the middle tower support to allow for relative motion, and the supplementary cable system to obviate crystallization at the supports, are described. This paper was presented at the Pacific Coast convention.—*Journal of A. I. E. E.*, September, 1923.

Overhead-Line Alignment Charts.—K. RIEDLINGER.—A set of alignment charts is shown from which can be obtained readily all required characteristics for a line stretched between two towers. The advantage of these charts over previously published ones is the need of only one curved scale for all kinds of single or bi-metallic conductors. The use of these charts for transmission lines or for catenary railway lines is explained by two examples.—*Elektrotechnik und Maschinenbau*, Sept. 23, 1923.

Units, Measurements and Instruments

X-Ray Examination of Materials.—A. G. WARREN.—The author describes the aspects of radiography, showing how the technique of the subject has been developed and indicating the lines along which progress may be expected in the future. He describes how the ordinary inspection of metals resolves itself into the detection of faults—that is, lack of homogeneity, flaws, cavities, presence of foreign materials, bad welds, etc.—and considers the detection of hidden bad workmanship, the examination of sealed bodies which it is undesirable or unsafe to dismantle, the examination of alloys, etc.—*Journal of Institution of Electrical Engineers* (*England*), September, 1923.

Electrical Strain Gages.—The Bureau of Standards has recently completed the work of assembling, testing and calibrating thirty-six electrical strain gages for the Bureau of Aeronautics of the Navy. These gages, together with twenty-four others previously supplied to the bureau, were recently installed on the navy dirigible ZR-1 at Lakehurst, N. J. The gages are being used for the continuous measurement of stresses in various parts of the dirigible during flight.—*Technical News Bulletin No. 78 of the Bureau of Standards.*

Selection and Care of Pyrometers.—J. W. CONZELMAN.—After explaining the fundamental principles underlying the operation of the four main types of electrical pyrometer—namely, thermocouple, resistance, radiation and optical—this article gives many practical hints on the selection and care of thermocouple instruments. These include detailed instructions for making, calibrating and installing.—*Power*, Oct. 23, 1923.

Two Photographic Methods of Studying High-Voltage Discharges.—K. B. MCEACHRON.—An abstract of this paper may be found in the ELECTRICAL WORLD report of the A. I. E. E. summer convention, July 7, 1923, page 17.—*Journal of A. I. E. E.*, October, 1923.

Illumination

Projection of Light.—W. J. JONES and E. A. MARX, JR.—Experiences with the use of gas-filled electric lamps in optical lanterns are summarized. It is shown that under the best conditions the percentage of the original light reaching the screen does not exceed 5 to 10, although it is evident that there is much difference between various forms of lanterns in this respect. In the motion-picture projector the proportion of light reaching the screen is even less.—*Illuminating Engineer* (*England*), Vol. XVI, No. 3.

Development of the Electric Incandescent Lamp.—B. P. DUDDING and C. J. SMITHELLS.—The first of a series of articles dealing with the development of incandescent lamps. The first article outlines the history of this type of lamp from the early platinum filaments of Grove and other experimenters to the modern gas-filled tungsten-filament lamp. Early metal filaments proved unsuitable, and the carbon filament took their place about 1880. The metallized carbon-filament lamps of 1907 had an efficiency of 3.5 watts to 4 watts per spherical candle. Experiments upon increased selective radiation led to the manufacture of carbon-silicon lamps and the Nernst lamp, the latter employing rare-earth filaments, with a degree of success which was

overshadowed by the introduction of metallic-filament lamps. The latest development of gas-filled lamps has improved the efficiency of electric incandescent lamps from 9 watts per candle of the ordinary carbon lamp to about 0.7 watt per mean spherical candle.—*Beama*, October, 1923.

Motors and Control

Electricity as Applied to Steel Mills.—Ten articles in this issue are devoted to the electrification of steel mills, particularly to motors and control for steel-mill drive. H. L. Barnholdt considers the direct-connected induction motors versus geared motors for rolling iron and steel. J. H. Ashbaugh gives a treatise on the speed regulator for individual motor-reel drive. Among the other subjects discussed are the foot control for main reversing-mill motors and strip mills and the electric drive for cold-rolled steel strip reels.—*Electric Journal*, September, 1923.

Ratings of Industrial Electric Motors and Generators.—C. RODGERS.—A short review is given of the changes and developments during the past few years of the standard specifications for the rating for motors and generators. The temperature that insulation will stand, the electric limits, commutation and pull-out torque imposed by the design and the mechanical limits such as strength of shaft for which the machine is built are discussed.—*Beama*, October, 1923.

Automatic Starters for Synchronous Motors.—Two types of starters are described, one for starting on full voltage and the other for part voltage. A frequency relay is used to close the field switch at the proper time for each method.—*Power*, Oct. 16, 1923.

Heat Applications and Material Handling

The Lifting Magnet.—Labor shortages and rising production costs demand practical solutions for material-handling problems. It is shown in this article how by an investment of $1,600 one lifting magnet can do the work of sixteen men and do it at a cost of $1.60 per day, all charges included. The several practical applications of lifting magnets are discussed.—*Blast Furnace and Steel Plant*, August, 1923.

Electric Arc Welding with Alternating Current.—O. WUNDRAM.—This paper explains the very low efficiency of direct-current welding, partly due to the required motor-generator set and partly to the many necessary interruptions of the welding to renew electrodes or to clean the piece on which work is being done. During these interruptions the set is left running, and a total efficiency of 50 per cent or less may be the best obtainable. The poor results obtained with alternating-current welding are ascribed to the use of improperly designed transformers. High-ignition voltage, independence of voltage from length of arc within wide limits during welding and zero voltage at short circuit are the desirable characteristics of a welding transformer. These characteristics can be had with a very elastic coupling between primary and secondary windings, giving high leakage. A machine of this type is described with which successful welding at an efficiency of between 75 per cent and 80 per cent has been actually accomplished. The rectifying action of an arc between iron electrodes is a welcome addition and advantage of alternating-current welding. The high efficiency and simplicity of alternating-current welding are promising features of this method.—*Elektrische Betrieb*, Sept. 24, 1923.

Electrophysics, Electrochemistry and Batteries

Multiple Electrode Systems.—A. H. HEATLEY.—A study is made of current distribution in electroplating baths. From Ohm's law a general theory is developed for current distribution in an electrolyte with n electrodes and is tested experimentally for $n = 3$, 4 and 5. Equations are developed, and their possible application in electroplating is discussed. Experiments in a simple case yield confirmatory evidence. Formulas developed in a previous paper are shown to have a limited application, and a new definition of throwing power is suggested.—*Paper presented before American Electrochemical Society at Dayton, Ohio*, Sept. 27-29, 1923.

Manufacture of Chemicals by Electrolysis.—ALBERT CLARKE.—In this article, the third of a series, organic compounds as prepared by electrolysis are considered. In the preparation of organic chemicals by electrolysis the two main objects which have been pursued by the electrochemists have been to make use of the hydrogen evolved at the cathode in an acid or alkaline bath for reducing purposes and the oxygen which is given off at the anode for oxidizing purposes. It has been found possible to substitute organic groups by halogens and to bring about the reaction known as condensation. The author treats the subject according to the reaction involved for reduction, oxidation, substitution and condensation, in preference to describing isolated instances of the manufacture of specific bodies.—*Beama*, October, 1923.

Traction

Automatic Train Control.—The Chicago & Alton Railroad is making a test of an automatic train-control device of the intermittent induction type, which, with no change in the engine equipment, but with the addition of a slow-acting relay, may also have the speed-control feature as well as the automatic stop. The six-page article discusses the device in detail, its installation and operating results.—*Railway Review*, Sept. 15, 1923.

Development of Street-Railway Cars.—As the convention number, preceding the meeting of the American Electric Railway Association at Atlantic City, Oct. 8-12, this entire issue is given over to car development. The purpose is to bring before the industry a broad perspective of the direction and nature of recent development in electric railway car design. The articles point out the trend of development, the good and the fallacious, and indicate what seem likely to be, or what may well be, the future lines of development. Eight articles cover the subject.—*Electric Railway Journal*, Sept. 29, 1923.

Railroad Electrification in the Dutch East Indies.—G. DE GELDER.—A detailed technical and economical discussion is given of railroad electrification in general and as applied to this territory. Water power will be used exclusively. Power from the same system will also be available for industrial and for home consumption. Some features of the first line, now under construction (Batavia-Meester Cornelis-Buitenzorg), are the 70,000-volt transmission line and 1,500-volt direct current for railroad use. Motor-car trains will be used extensively, equipped with automatic starting devices, with locomotives for rush hours and freight only.—*Ingenieur (Holland)*, Sept. 8, 1923.

Electric Mine Haulage.—J. F. MACWILLIAMS.—A discussion of the maximum grade for locomotives, when and how to repair wheels, safety features of locomotive design, burn-outs due to defects in series fields and advantages of good feeders and return circuits.—*Coal Age*, Oct. 25, 1923.

Telegraphy, Telephony, Radio and Signals

Telephone Transmission Over Long Distances.—H. S. OSBORNE.—Similarities and contrasts of power transmission and telephone transmission over long distances are pointed out. The problems of telephone transmission on open-wire lines are illustrated by a discussion of the methods by which the over-all efficiency of the transcontinental telephone circuit has been greatly improved. A brief discussion is given of recent important developments in telephone transmission through cables over long distances. A demonstration talk between Havana, Cuba, and Avalon, on the Catalina Islands off the Pacific Coast, is described as an illustration of what can be done with the commercial telephone system in its present stage of development. This paper was presented at the Pacific Coast Convention of the A. I. E. E.—*Journal of A. I. E. E.*, October, 1923.

Single-Layer Inductance Coils for Radio-Frequency Standards.—Detailed instructions for the construction of a series of single-layer inductance coils suitable for radio-frequency standards are described. There are seventeen coils in the series, designed to cover the approximate range of 8 microhenries to 5,000 microhenries. Beginning with the smaller coil, each successive coil has approximately one and a half times the inductance of the previous coil.—*Letter Circular No. 103 of Bureau of Standards.*

New Books

Reviews of the Latest Contributions to Technical, Industrial and Commercial Literature of Particular Interest to Members of the Electrical Industry

Kent's Mechanical Engineers' Handbook

Tenth edition, 1923. Rewritten by R. T. Kent and staff. New York: John Wiley & Sons, Inc. 2,247 pages, illustrated.

"Kent's Handbook" has long been a useful and valuable source of practical engineering information, and the new edition in every way sustains the standards set in the past and indeed improves upon them. The book has been almost completely rewritten and much new material has been added. The balance is excellent and the contents represent the latest opinion and knowledge of practicing engineers and specialists.

The power section is particularly good, with its new and extended steam tables and information about the different practices which are changing the art so rapidly. Many new and rearranged tables and charts offer useful material on all phases of mechanical engineering, with particular emphasis placed on the properties of materials and the standards adopted by engineering and manufacturing organizations.

New chapters on reinforced concrete, automotive engineering, aëronautics and heat insulation are included, and many of the others have been greatly extended, including that on electricity. The indexing and printing are of a high standard, and the practical viewpoint has been kept in producing a complete and valuable volume. The authors have included also many thousands of references for the convenience of readers who wish to obtain more detailed information directly from source authorities.

Absolute Measurements in Electricity and Magnetism

By Andrew Gray. Second edition, rewritten and extended. New York: Macmillan Company. 819 pages, illustrated.

An advanced text for colleges and those interested in the fundamental aspects of electrical science. The book represents an immense amount of work and contains much new material on electromagnetic and electrostatic measurements and units. The treatment of inductance is particularly good and covers the application of the theory to the quantitative calculation of coils.

The fundamental experiments in electromagnetic phenomena are reviewed and discussed, units are treated thoroughly and measurement methods are treated in detail. The scope of the work is very large, covering, among others, chapters on units and dimensions of physical quantities, magnets and magnetism, magnetic induction, induced magnetization, unit currents and currents in networks, electromagnetism, calculation of coil constants, mutual influence of currents, measurement of activity in electric circuit, measurement of inductances, electrostatic measurements, medium inductivity effect and measurement of specific inductive capacity. Appendices cover details of the subject matter in greater detail and contain valuable tables of constants and units. The book is carefully indexed and edited and should be in the library of all those seeking fundamental knowledge of electromagnetic phenomena and measurements.

Der Drehstrommotor

By Julius Heubach. Berlin: Julius Springer. 599 pages, 222 illustrations.

This is the second edition of a text first published some twenty years ago. In comparison with American texts it is unusual. In fact, so far as the writer is aware, there is no book in the English language in which the principles of the polyphase induction motor *alone* are spread over almost 600 pages. Rare indeed is the American textbook on the whole field of alternating-current machinery that approaches this size, and into most of them is crowded, in addition, something of an exposition of the principles of alternating-current circuits. With this situation in mind, the writer was prepared to find considerable padding. But such is not the case. On the contrary, the whole treatment is characterized by a thoroughness that is quite typical of German and English texts.

As in the earlier edition, the theory is based on the method of fluxes and the circle diagrams of Heyland, Ossanna and Sumec. The leakage reactance and equivalent circuit method of Arnold and Steinmetz are not mentioned. About one-half of the book is devoted to a most detailed derivation and explanation of these circle diagrams and to the calculation of the distribution of the magnetic field, including the leakage fields. The remainder of the book contains chapters on testing of motors, the induction generator, single-phase motor, design and the effect of variation of voltage, frequency and the various motor constants on the behavior of the machine. This last is very thoroughly done, and the effects are illustrated by numerical calculations for a given motor.

The mathematics in the book is extremely simple, resort being had to the calculus only rarely. This was to be expected from the fact that the author leans so heavily on the circle diagrams. The book should appeal to those who wish a strong treatment of the induction motor from the standpoint of fluxes rather than leakage reactances. As the author intimates in the preface, however, the discussion is rather too elementary and extended for specialists in this field. P. H. DAGGETT.

Patents Throughout the World

By William Wallace White and Wallace White. New York: Trademark Law Publishing Company. 244 pages.

The authors of this work have done an important job in digesting and arranging in a systematic way the patent laws of the nations of the world. A series of tables has been prepared to show at a glance the conditions under which patents may be obtained in the various countries, and these answer at once questions raised in connection with the filing of forms and applications. The digests of the patent laws are arranged in convenient form for perusal by the non-technical patent man or the patent attorney. A good index aids greatly in making the book usable, and an introductory chapter of general information regarding patents makes clear the terminology used in the succeeding chapters. Details concerning licensing, assignment of patents, patent rights and what things are patentable are covered in the digest of the laws of the several countries. The book should be well received by those interested in patents.

Aide-Mémoire et Schémas de l'Entrepreneur-Electricien

By P. Maurer. 620 pages, 262 illustrations. Paris: Dunod.

A handbook for the practical wireman, containing in eighteen chapters all information needed by the man installing or repairing electrical apparatus and machinery in the field. Connection diagrams for machines and plants form the bulk of the volume. Most of the illustrations are poor, and the total absence of halftone cuts, together with inferior paper, detracts from the appearance of the book.

A. PALME.

Books Received

Automatic Telephone Systems—Vol. II. By William Aitken. New York: D. Van Nostrand Company. 227 pages, illustrated.

Les Transformateurs. By P. Bunet. Paris: Librairie J.-B. Baillière et Fils. 632 pages, illustrated.

Valence and the Structure of Atoms and Molecules. By Gilbert Newton Lewis. New York: The Chemical Catalog Company. 172 pages, illustrated.

The Prevention of Vibration and Noise. By Alec. B. Eason. London: Henry Frowde and Hodder & Stoughton. 163 pages, illustrated.

Practical Control of Electrical Energy. By A. G. Collis. London: Henry Frowde and Hodder & Stoughton. 157 pages, illustrated.

Hydro-Electric Power Stations. By David B. Rushmore and Eric A. Lof. New York: John Wiley & Sons, Inc. 830 pages, illustrated.

News of the Industry

Chronicle of Important Events and General Activities, Announcements and Reports of Association Meetings, Court Decisions and Commission Rulings and News of Electrical Men

Ferris Amendment Beaten

New York State Gives Large Majority Against Power Houses and Lines in Forest Preserve

A MAJORITY of great size was registered at the general election in New York State on Tuesday of this week against the so-called Ferris amendment to the state constitution, which, as readers of the "News of the Industry" are aware, would have permitted the building of electric transmission lines and power houses in territory not to exceed 3 per cent of the State Forest Preserve in the Adirondack Mountain region.

The complete vote on this amendment in Greater New York City was 501,650 against the amendment and 257,947 in its favor, or approximately two to one against it. Up the state less crushing but still decisive majorities appear at this writing to have been cast against the proposition in almost every county. Five other proposals submitted to the voters of the state were carried, in the main by large majorities, the effect of the determined attack on the water-power amendment being thus clearly shown.

The Ferris amendment, as the ELECTRICAL WORLD'S news columns have made clear, had the support of many prominent engineers and others interested in electrical development, but it was unable to make headway against the determined opposition of those apposed to any encroachment whatsoever on the state lands, supported as they were in this instance by the Governor, by many influential newspapers and by virtually all advocates of public as opposed to private hydro-electric development.

The amendment as worded would have permitted either state development or development by private companies under fifty-year leases. No new amendment can be submitted to the voters for at least two years, as a constitutional amendment must before submission be passed by two successive legislatures.

Experimental Rural Line to Go Ahead in Minnesota

The proposal for an experimental rural line in Minnesota which, as told in the ELECTRICAL WORLD for Oct. 20, page 825, was drawn up at a recent conference between farmers, representing the Minnesota Farm Bureau Association, and officials of the Northern States Power Company is to be carried out in the near future. The location of the line has been changed from West Concord to Red Wing, about 40 miles away. The line at the latter point will be from 5 to 8 miles in length and will serve not more than three farms per mile, or a minimum total of fifteen farms. Among these are a poultry farm, a beef-cattle ranch and a "silver-fox farm," though most of the farms are diversified in character. There is an agricultural school in the district and several of the farmers along the projected line are graduates of the Minnesota Agricultural College. It is expected that the experiment will be in full swing before winter sets in.

Muscle Shoals Still Topic

Ford's Friend's Active—Weeks Favors Initial Installation of Eight Units at Wilson Dam

MUSCLE SHOALS will not down. Apparently it is slated for very active consideration at the forthcoming session of the new Congress. Friends of the Ford offer are very active. Their latest proposal is that the government shall construct a steam plant equal to that at Gorgas so as to meet the conditions of Mr. Ford's proposition. Representative Madden of Illinois, the chairman of the appropriations committee of the House of Representatives, on Nov. 5 acquainted the President with a proposal that the government duplicate the Gorgas plant at a point 10 miles southwest of the Alabama Power Company's plant. It is understood that the President favors an early determination of the disposition which is to be made of Muscle Shoals.

Two new offers for the government's Muscle Shoals properties are about to be made, it is reported. Sight should not be lost of the fact that the Alabama Power Company never has withdrawn its offer.

Interest in the project was stimulated by the request of the Secretary of War for an extra budgetary appropriation of $2,000,000 so that four more 30,000-kw. units can be installed at Wilson Dam in addition to the four covered by the first plan. This action is said to have followed a request to that effect made by Senator Underwood. It is known, however, that the Chief of Engineers long has been of the opinion that the installation of four additional units is justified. Since provision is being made for the ultimate installation of eighteen units, the proposed additions in no way affect the construction program of the government, which is now 60 per cent complete.

Power Board Activities

Portland Company Wants to Retain Construction Railroad—License for Priest Rapids Asked

THE chief engineer of the Federal Power Commission, Col. William Kelly, will report in person on the controversy which has arisen as to the disposition of the 26-mile railroad line built by the Portland (Ore.) Railway, Light & Power Company in connection with its water-power development on the Klackamas River, 50 miles south of Portland. The company desires to retain the railroad as a permanent adjunct of its water-power development, to insure the ready transfer of heavy machinery to the plant in case of accident. Officials of the Forest Service object to this plan unless the road is made a common carrier and hold that its presence, if available for limited use only, in effect bottles up the upper watershed of the Klackamas.

The Washington Development & Irrigation Company has made formal application to the commission for a license covering its 350,000-hp. project at Priest Rapids. The company has complied with the conditions of the preliminary permit, which was granted March 3, 1921. It is assumed that the commission will authorize the issuance of the license at an early date, since all of the questions involved were threshed out at the time the preliminary permit was granted.

The proposed development of water power at Kelly's Ford above Fredericksburg, Va., on the Rappahannock, does not come within the jurisdiction of the Federal Power Commission, the chief of engineers has reported.

Another Big Plant for Indianapolis Light & Heat

Construction of another large electric plant to serve the Indianapolis and central Indiana territory will be completed late in 1925 by the Indianapolis Light & Heat Company, according to a recent announcement by C. C. Perry, president of the company. He said preliminary work on the project has been begun on a 145-acre tract about 8 miles southwest of the city on White River. The plant will cost about $5,000,000 and will involve an expansion program in addition to improvements now being made in the equipment of the company's physical property. These improvements, constituting the 1923 development program, are costing about $1,700,000.

For a Study of Technical Education

Carnegie Corporation Gives $108,000 for Investigation by S. P. E. E. of Engineering Training—W. E. Wickenden Chosen to Conduct the Work

AN APPROPRIATION of $108,000 for the study of engineering education was made on Oct. 31 by the Carnegie Corporation of New York, the study to be conducted by a director responsible to a committee of the Society for the Promotion of Engineering Education. As the ELECTRICAL WORLD goes to press news comes from the committee that W. E. Wickenden, assistant vice-president of the American Telephone & Telegraph Company, has accepted appointment as director.

The resolution adopted by the Carnegie Corporation sets aside for the purpose $24,000 during the present fiscal year and $12,000 during the fiscal year 1924, with the understanding that if, in the judgment of the executive committee, substantial progress shall have been made in this study by Jan. 1, 1925, the balance of the $108,000 will be made available to the society as follows: $24,000 additional during the fiscal year 1924, $48,000 during the fiscal year 1925.

This appropriation is the direct result of effort by a development committee appointed in the summer of 1922 to study for three years the development of the Society for the Promotion of Engineering Education and to formulate an answer to the question "What can the society do in a comprehensive way to develop, broaden and enrich engineering education?" This committee, appointed by President C. F. Scott, professor of electrical engineering at Yale, comprises, besides himself, Dean M. E. Cooley of Michigan, John H. Dunlap, secretary of the A. S. C. E.; Prof. D. C. Jackson of the Massachusetts Institute of Technology and President F. W. McNair of the Michigan College of Mines.

OBJECT OF COMMITTEE

Conferences were held by Professors Scott and Jackson with Dr. Henry S. Pritchett of the Carnegie Corporation with the view of obtaining a suitable appropriation. The object of the committee was stated in a memorandum to Dr. Pritchett to be a "discriminating study of the present state of engineering education" and "the fitness of the present-day curriculum for preparing the student for his profession." To this end it is purposed to relate the investigation, which is primarily to follow the educational point of view, to other studies on the same subject, particularly the one under way by the National Industrial Conference board, which is being conducted from the standpoint of the employers of engineers and of practicing engineers themselves. The S. P. E. E.'s committee will "study the process by which the curriculum of fifty years ago has come to its present form; it will seek to set forth the nature and the weakness of the curriculum as at present administered, and it will indicate such modifications or developments as would seem to make for a sound, well-balanced and fruitful course of study for engineering students."

ORGANIZATION AND PROGRAM

The following organization and program is suggested as one fitted to this investigation:

1. The inquiry shall be carried on under the general direction of a committee appointed by the Society for the Promotion of Engineering Education, with the understanding that this committee shall include at least two men chosen from outside the society and the engineering profession, whose point of view will be primarily that of the trained teacher.
2. The active conduct of the study will be under the supervision of a director appointed by the committee, whose office shall be in New York, and, if possible, in the Engineering Building. The publication of the results of the study will be also in the hands of the director.
3. The director shall organize committees in the faculties of as large a number of engineering schools as may be practicable, who shall co-operate with the committee and with the Society for the Promotion of Engineering Education in the prosecution of this study.
4. Inasmuch as a study of the engineering curriculum of American schools should include a knowledge of and comparison with the best schools in Europe, it is considered necessary that the director of the committee shall, as soon his work is organized, visit such engineering schools of European countries as may throw light upon the best methods in engineering education.

Replying to the committee's overtures, Dr. Pritchett said that the study proposed seemed to him essential and that he could think of no better means of carrying it out than through the organization and program described.

Dr. F. P. Keppel, who has succeeded Dr. Pritchett as head of the Carnegie Corporation, has indorsed the movement and is taking an active interest in it.

Rates of Coast Valleys Company Are Slashed

Electric rates charged by Coast Valleys Gas & Electric Company have been reduced 8 per cent for lighting and 14 per cent for agricultural power use by the California Railroad Commission. The Coast Valleys Gas & Electric Company purchases power wholesale from Pacific Gas & Electric Company and supplies Monterey, Pacific Grove, Carmel, Salinas, King City and surrounding territory on the Monterey peninsula and in the Salinas Valley.

Two uniform lighting rates are provided by the new schedules, one for towns and the other for rural territory, eliminating existing distinctions. Industrial power rates are generally reduced to all consumers except those whose operations are unusually continuous through the month. The average reduction is approximately 8 per cent. An unsatisfactory schedule of agricultural rates has been replaced by a simplified schedule designed to eliminate complaints. The company will be obliged to furnish transformers, which have heretofore been furnished by consumers. On account of the present disjointed rate a few bills may be raised and others reduced below the average.

Lighting service applicable to cities and towns throughout the territory served will be, for the first 10 kw.-hr. or less per month, $1; for the next 40 kw.-hr., 7 cents; for the next 150 kw.-hr., 6 cents; for the next 800 kw.-hr., 5 cents, and all over 1,000 kw.-hr., 4 cents. The rates applicable outside cities and towns begin with a charge of $1.25 for 10 kw.-hr. or less, otherwise they are the same as the urban rates.

The electric rates of the Coast Counties Gas & Electric Company, which also purchases electricity wholesale from the Pacific Gas & Electric Company, distributing it in Santa Cruz, Watsonville, Hollister, Gilroy and surrounding territories, were also reduced, all towns being placed upon one rate and all rural territory upon another. The total reduction in lighting rates is about 15 per cent, but because of the different schedules on different parts of the system some consumers will be reduced much less than 15 per cent and others much more. Industrial power rates are reduced an average of 18 per cent over the entire system. Agricultural rates are reduced by the entire elimination of the surcharge and by slight further reduction, making a total reduction of approximately 12 per cent. The general lighting rate schedules within cities and towns and outside incorporated territory are the same as for the Coast Valleys Gas & Electric Company.

Clearing House Established for State Associations

To co-ordinate the activities of state, sectional and national sections of electric utility organizations, as well as to serve as a clearing house for practices which can be used to advantage by all of them, an organization was formed at a recent meeting of secretaries of such associations at Atlantic City. E. N. Willis of Dallas, Tex., was elected president and J. N. Cadby of Madison, Wis., secretary. In forming this organization it was recognized that varying methods have been successfully employed to increase interest and attendance at meetings in different parts of the country and to enhance the usefulness of the organizations. The new body hopes to make all these methods equally available to all sections, and all are invited to contribute ideas. It was the general opinion that the relation between state and sectional associations with respect to legislation could be improved if each association were advised of legislation pending in other states, since it often occurs that the same bills are pending in several states simultaneously. The secretaries of the state associations of Ohio, Indiana, New York, Massachusetts, Texas, Wisconsin and Illinois and of the American Electric Railway Association attended the Atlantic City meeting.

Work Begins on Dix River Plant

This Hydro-Electric Project Will Be Interconnected with Other Middle West Utilities Properties—Rock-Filled Dam 270 Ft. High and 760 Ft. Wide

ELECTRICAL interests in Kentucky and neighboring states are watching with interest the construction of the Kentucky Hydro-Electric Company's new plant, which will be 3½ miles from the mouth of the Dix River at a point where it flows into the Kentucky River at High Bridge, 20 miles from Lexington, Ky., and about 100 miles from Cincinnati on the north and 75 miles from Louisville on the west. The rock-filled dam, now begun, will be of the type of the Strawberry Dam in California. It will be 270 ft. high and 760 ft. across the gorge, thus ranking as one of the biggest east of the Rocky Mountains, and will form a lake 36 miles long and in places more than a mile wide.

This plant will be completed about Jan. 1, 1925, at a cost of about $7,000,000, including 95 miles of double-circuit steel-tower transmission lines to Lexington and to the Ohio River near Louisville. The plant will have a capacity of 36,000 hp., it being intended to connect three 12,000-hp. Morris waterwheels to three 8,000-kw. Allis-Chalmers generators. The power house will be built in the old river channel, just below the dam.

The Kentucky Hydro-Electric Company is a subsidiary of the Middle West Utilities Company. Its transmission lines will tie in with the present transmission system of the Kentucky Utilities Company at Lexington and with that of the Interstate Public Service Company at Louisville, these companies being also controlled by the Middle West Utilities Company, which, as already told in the ELECTRICAL WORLD, is planning a big steam plant at Jeffersonville, Ind., on the other side of the Ohio River. A transmission line will also run southeast from the Dix River power plant 80 miles to the plant of the Kentucky Utilities Company now being built at Pineville, Ky., and still further to Varilla, Ky., and Pocket, Va. This line is being constructed by the Kentucky Utilities Company. Eventually a line will be carried to western Kentucky to augment service to coal mines and other industries in that region.

The Dix River project will be the first large hydro-electric development in central Kentucky, though the hydraulic power possibilities of the river were foreseen in the days of Boone. The plans include construction of a highway bridge across the gage, 800 ft. long, and the building of new waterworks for Danville, Ky., whose present plant will be flooded out.

Savings Banks to Make Survey of Public Utility Securities

The public utility committee of the National Association of Mutual Savings Banks of the United States has begun an intensive study of public utility securities with a view to broadening and strengthening state regulation as applied to them, according to the *Savings Bank Journal*, the official organ of the association.

In the preliminary survey of the committee it is planned to assemble data only for a limited number of companies, possibly not more than fifty, one or more of their issues to be of the highest possible grade and therefore a potential savings bank investment. Electric light and power, gas and telephone companies alone will be considered.

"This discussion reflects the great interest which savings banks have displayed in recent years in public utility securities," says the *Journal*. "They have been in the foreground upon every occasion when search has been made for additional classes of legal investments which would meet the three recognized savings bank canons—safety, liquidity and yield. But they still are not legal in some states, notably New York, and in general those states which permit their savings banks to purchase public utility issues limit the companies to those within the state."

Middle West Executives in Conference

More than one hundred executives of the Middle West Utilities Company attended a three-day session in Chicago from Oct. 24 to 26. This conference discussed problems ranging from safety and insurance, transmission systems, rural lines and farm service to stock-selling conferences. Delegates of the women's committee on public relations from the various Middle West properties were present. The conference terminated on Friday night with a banquet at the Blackstone Hotel, where M. H. Aylesworth, executive manager N. E. L. A., discussed "The Normal Pulse of the Public." F. K. Schrader of the Halsey-Stuart Company spoke on "Public Utility Financing from an Investment Banker's Viewpoint," and W. J. Hodgkins of the Lake Superior District Power Company dealt with the "Value of a Conference to an Executive."

Radio Bill to Come Up Again in Next Congress

The radio-control bill which failed of passage in the last Congress because of congestion of the Senate calendar in the closing hours of the session will be introduced again early in the next session, according to information received by Secretary of Commerce Hoover. The Secretary said that his information was to the effect that the general lines of the White bill in the last session would be followed by the new measure, with modifications which will mean simplification, worked out as the result of experience gained in the intervening months.

The principal features of the measure are to vest control over radio in

SITE OF DAM TO BE ERECTED ON DIX RIVER BY KENTUCKY HYDRO-ELECTRIC COMPANY

the Department of Commerce, requiring transmitting stations to obtain licenses so that confusion in the air may be eliminated by regulations stipulating wave lengths to be used and hours of sending.

St. Joseph, Mo., Will Purchase Central-Station Energy

The Missouri Public Service Commission has approved a contract entered into by the city of St. Joseph, Mo., and the St. Joseph Railway, Heat, Light & Power Company under which the city temporarily discontinues the operation of its municipal lighting plant and purchases electrical energy for street lighting and other city purposes from the company. The contract provides the city shall pay a rate of 1.8 cents per kilowatt-hour for the first 500,000 kw.-hr. per year and 1 cent per kilowatt-hour for all in excess.

At a public hearing held in St. Joseph before members of the state commission evidence was introduced tending to show that it would cost the city $38,000 for energy bought from the company to supply 1,500 street lamps, while it was costing the city between $40,000 and $50,000 annually to operate its own plant, which supplied light for only 500 street lamps.

Topics at Forthcoming Convention of A. S. M. E.

Among subjects of central-station interest to be discussed at the coming meeting of the American Society of Mechanical Engineers at the Engineering Societies Building, New York, Dec. 3-8, are these: "Factors in the Spontaneous Combustion of Coal," by O. P. Hood; "Economic Phases of Coal Storage," by F. G. Tryon; "Coal Handling and Coal Storage," by H. E. Birch and H. V. Coes; "Economy Characteristics of Stage Feed-Water Heating by Extraction," by E. H. Brown and M. H. Drewry; "High Pressure, Reheating and Regenerating for Steam Power Plants," by C. F. Hirschfeld and F. O. Ellenwood; "Reheating in Central Stations," by W. J. Wohlenberg; "Margins of Improvement in Central-Station Steam Plants," by E. L. Robinson; "Boiler-Test Results with Preheated Air at Colfax Station," C. W. E. Clarke; "Boiler-Plant Economics," N. E. Funk and F. C. Ralston, and "The Gibson Method and Apparatus for Measuring the Flow of Water in Closed Conduits as Applied in Testing the Efficiencies of Waterwheels in Hydro-Electric Power Plants," by N. R. Gibson. The power test codes committee of the society will hold a public hearing on the code for stationary steam generating units.

On Wednesday evening, Dec. 5, there will be a joint session with the American Institute of Electrical Engineers and the American Society of Civil Engineers, when John R. Freeman, Providence, will speak on "Fundamentals of Hydro-Electric Equipment."

"Electric Fleet" of United States Navy Complete

The U.S.S. *West Virginia*, last of the battleships to be built by the United States government under the Washington Arms Conference limitation and sixth to be equipped with the electric drive, thereby completing the "electric fleet," will be commissioned at the Newport News shipbuilding yards about Dec. 1. She will be a sister ship to the *Maryland* and the *Colorado*.

The *West Virginia* is electrical throughout. Her main propulsion machinery consists of two Curtis steam turbo-generators, designed to develop 12,600 kw. at a speed of 2,150 r.p.m. to drive the ship 21 knots. These supply power to four 8,000-hp. General Electric induction motors, directly connected with the four propellers and turning at 177 r.p.m. The motors, among the largest ever built, are 12 ft. in diameter, weigh 62 tons, and the 32,000 hp. thus available for propulsion purposes is enough to supply power to a city of 100,000 population. The two turbo-generators, supplied with steam generated by eight oil-burning boilers, can be run independently. Either is capable of driving the ship up to a speed of about 17 knots. The power generated by them is used for no other purpose than propelling, electrical current for other needs being generated by six 300-kw. generators and two 400-kw. Diesel generators.

Virtually every electrical appliance used afloat and ashore has been installed in this new battleship. The electrical equipment includes radio telegraph, loud-speaking telephones, ordinary telephones, gyroscope compass, steering gear, anchor windlass, capstan, boat cranes, winches, air compressors, air heaters, turret training, turret-gun elevating, ammunition hoists, gun firing, range signaling, powder-testing oven, ice machines and much besides.

W. L. R. Emmet, consulting engineer of the General Electric Company, who advocated the principles of the electric drive as long ago as 1909, was instrumental in its adoption by the government and designed the first electric drive installed by the navy.

Commissioners Will Discuss Superpower at Miami

The official call for the thirty-fifth annual convention of the National Association of Railway and Utilities Commissioners has just been issued by Commissioner Dwight N. Lewis of Iowa, the president. The convention will be held in Miami, Fla., beginning Dec. 4 next, and will last four days. Headquarters will be at the Hotel Urmey. The local arrangements are in the hands of R. Hudson Burr, chairman of the Railroad Commission of Florida, whose main office is at Tallahassee.

The sessions of the convention will be devoted mainly to the presentation and consideration of reports from twenty standing and special committees, which will, as usual, include such topics as public ownership and operation, safety of operation, service, rates, capitalization, motor vehicle transportation, statistics and accounts. A discussion on the superpower movement will be led by W. D. B. Ainey, chairman of the Public Service Commission of Pennsylvania.

Weymouth Outlines Boulder Canyon Project

Plans are now being perfected in the Denver offices of the Reclamation Service for the projected Boulder Canyon dam on the Colorado River near Las Vegas, Nev., which will cost between $40,000,000 and $50,000,000, and for a power project in connection with the dam, which will cost a similar sum. Construction of this huge dam and power project will, it is understood, be recommended to Congress when it meets in December by the Reclamation Service.

According to F. E. Weymouth, chief engineer for the Reclamation Service, the proposed Boulder Canyon development would make possible the protection of life and property in the Imperial Valley through the control of floods on the Colorado River, the reclamation of 2,000,000 acres of land below the dam, the reclamation of 4,000,000 acres above the dam, and the development of a continuous flow of 800,000 kw. to 1,000,000 kw. of electricity, providing power for the industries of California, Nevada, Arizona and southwestern Utah.

The project as now outlined involves the storage for irrigation and power purposes of 34,000,000 acre-feet of water. It is estimated that the cost of the development would be repaid to the government in a reasonably short period by the sale of electrical energy.

Taxpayer's Suit Against Los Angeles Bureau

A taxpayer's suit has been brought by W. W. Mines, a real-estate dealer of Los Angeles, against the municipal Bureau of Power and Light to prevent expenditures by the bureau designed to promote the Boulder Canyon power project, from which the city authorities hope to procure a great additional source of power supply. The rapidly growing population of the southern California City makes it very difficult for the municipal plant to keep pace with the demands upon it. Contract has been awarded for nineteen transformers to be installed in new substations, and the program calls for the installation of thousands of miles of transmission-line extensions. The City Council by a majority of six to three has passed an ordinance appropriating $25,000 to enable the Bureau of Power and Light to begin efforts to condemn the seventeen-million-dollar electric properties of the Los Angeles Gas & Electric Corporation.

British View of World Power Conference

It Is Not to Be Carried on for the Commercial Benefit of British Manufacturers Alone, but to Extend Educational Stimulus to Engineers of All Nations

[This article is based on the personal investigations of Paul Wooton, Washington correspondent of the ELECTRICAL WORLD, who has recently returned from England and France, where he covered several assignments for the ELECTRICAL WORLD and other McGraw-Hill engineering publications.—EDITORS.]

BRITISH electrical manufacturers have a deep conviction that anything which betters the status of the engineer helps them. They feel that they must depend on the engineer for much of the progress made by the industries which use electrical equipment and that they are dependent on him for most of the conceptions which require new applications of electricity.

It was that thought which induced the British manufacturers to propose the World Power Conference. The conference is to be held in July, 1924, during the British Empire Exhibition, but is no part of it. The principal nations of the world are participating in the power conference, while the exhibition is a family reunion of the commonwealths making up the empire.

There is every reason to believe that the World Power Conference was not proposed with the idea that it would be of greater commercial advantage to British manufacturers than to those of other countries. The real object unquestionably is to give the electrical engineers of the world, as well as other engineers interested in power in any form, an opportunity to add to their education and to broaden their views. By exchanges of views all will benefit from such a conference, it is believed. In that connection it is pointed out that electrical engineers are interested in more than the technical problems which confront them. They are interested in the management of properties and in the financing of development. It is in recognition of the broader functions which the engineer is coming more and more to exercise that the power conference expects to devote a considerable portion of its time to the discussion of the relationships between electrical undertakings and their financing.

The decision to call a power conference was reached by the British Electrical and Allied Manufacturers' Association before there was any thought of convening it during the British Empire Exhibition. In fact, there was objection on the part of many manufacturers to calling it at that time because of the belief that more time should be allowed for the preparation necessary for such a comprehensive conference. It was decided finally, however, that advantage should be taken of the presence in London at the time of the exhibition of a large number of engineers and business men and of the facilities for cheaper transportation then to be in effect.

The British manufacturers see in the conference, in addition to its service to engineers, an opportunity to acquire more exact knowledge as to the world's power resources. Every effort will be made to build up a comprehensive record, setting forth the exact situation existing in each country. This information, of course, will be available to all concerned. Much of the information on world power resources which does exist is of doubtful value because of the changed conditions which have come about since the war.

BRITISH CONSERVATISM DISAPPEARING

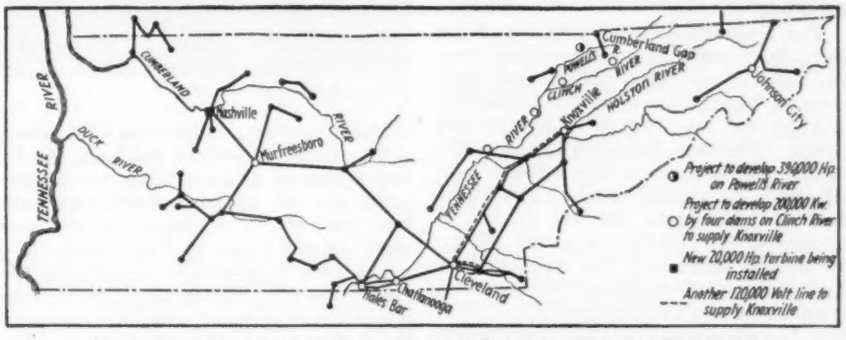
British interests are throwing off much of the ultra-conservatism that once characterized many of them. They are coming to the opinion, long held in America, that there should be liberal interchange of ideas and a minimum of secrecy. It is hard to keep secrets from any one who really wants to find out, they have learned, whereas the more open policy prevents duplication and eliminates waste. They realize that no one nation can supply all of the needs of the world for electrical equipment and now declare that they are convinced that it is better to co-operate in improving practice, undertaking standardization and reducing costs, thereby stimulating demand for products and increasing the capacity of the world to absorb them. It is in such channels that the thoughts of the British manufacturers are flowing. The idea will be worked out in detail and presented in papers and in discussion at the conference. Incidentally it has been decided that no time will be consumed in reading long papers. All papers will be printed in advance and distributed among those in attendance. The entire time at the sessions can then be devoted to discussion, with the idea of bringing out the condensed viewpoint of delegates on any particular paper.

The tentative program (see ELECTRICAL WORLD, Aug. 25, page 399), which embodies ideas presented by O. C. Merrill of the American committee and by J. B. Challies, the director of the water-power branch of Canada's Interior Department, has met with favor in France, Switzerland and Italy, which were the only countries heard from up to the time that Mr. Wooton left England. It is expected, however, that suggestions from these and other nations will be forthcoming which will meet with favor and be included.

While the British expect Americans to be their chief competitors, for all time to come, in the electrical field, they are outspoken in their desire to have Americans rather than others in this rôle. Some of them complain of alleged dishonest methods used by manufacturers in certain European countries. The fact that American costs of production are much higher than those of their Continental competitors doubtless is an important further factor in influencing them to take that view.

Electrical Development in Eastern Tennessee

The accompanying map, showing the power lines in Tennessee east of the Tennessee River, has been made by the Public Service Information Bureau of the state from data compiled by the Public Utilities Commission's engineers. It shows where the present high-tension lines of the power companies traverse middle and eastern Tennessee territory and indicates the new developments contemplated. There are more than 900 miles of high-tension power lines supplying the industries, mines, cities and towns of east Tennessee, and two-thirds of the power transmitted over these lines is hydro-electric. The ultimate capacity of the plants covered by applications now on file is estimated at 700,000 hp.



EXISTING AND PROJECTED HIGH-TENSION LINES IN EASTERN TENNESSEE

In the region of the Clinch and Powell Rivers are the great coal fields, which are rapidly being electrified, while the aluminum industry at Maryville is supplied with power for its electrical furnaces from the power plant at Cheoah, in North Carolina, and from a supplementary line of the Tennessee Electric Power Company, fed with power from the Ocoee River plants in Tennessee. Electric power serves another of the state's industries in the copper basin at Ducktown, while the zinc mine at Mascot consumes almost half as much power as the entire city of Knoxville. While these are the larger power-consuming industries in the state, thousands of essential indus-

tries, particularly the cotton mills along the Southern Railroad from Knoxville to Chattanooga, are dependent almost altogether on electric power. Power lines that reach to Mount Pleasant as a terminus for the phosphate fields there and to Nashville are fed from the same hydro-electric sources.

Delay on Clinch and Powell River Schemes Necessary

The survey of resources of the Tennessee River which is being conducted by army engineers will not have reached a point where reports will be available on the Clinch and Powell Rivers for at least a year. This means that the Federal Power Commission will not be able before that time to pass upon the applications of the Knoxville Power & Light Company, the Tennessee Electric Power Company and the Tennessee Hydro-Electric Company.

Development of Hiawassee

Southern Appalachian Power Company Sees Capacity of 200,000 Hp.—Andrews, N. C., Defiant

THE Federal Power Commission has received an application from the newly organized Southern Appalachian Power Company of Asheville, N. C., for a preliminary permit covering a 170-ft. dam and power structure at a point on the Hiawassee River one mile above Murphy, N. C. The development will be in the extreme western tip of North Carolina.

The Hiawassee is a tributary of the Tennessee and has its source just over the ridge from the Tugaloo and other streams which have been thoroughly developed on the eastern slope of the range. The dam proposed in the application would control the annual runoff of the river and provide a low-water flow of 1,300 cu.ft. per second. It is estimated that 50,000 hp. could be developed at this site. The most attractive feature of the project, however, arises from the fact that 400 ft. of head can be developed in the river below Murphy, which would, according to the promoters, make possible the development of 150,000 hp. in that stretch. The development would, it is claimed, increase the low-water flow at Muscle Shoals by 10 per cent, and it would benefit materially the Hales Bar project of the Tennessee Electric Power Company.

This project emphasizes the fact that power development can do more for the control of floods than many times the expenditure on the type of works usually employed in flood control. The Hiawassee development would control the waters falling on 400 square miles of drainage area. It would increase materially the navigable capacity of the Tennessee and in addition would create navigable pools above each of the four or five dams which eventually would be built.

Another feature of this application is the fact that the power developed is to be sold to a number of companies already operating distribution systems. Incidentally the development would drown out the dam proposed by the town of Andrews, N. C. It is this small municipality which is defying the Federal Power Commission. It has sold its bonds and has let contracts for its project, which is 7 miles above the site of the Southern Appalachian Power Company. Materials are being transported to the dam site, it is understood. The district representative of the Corps of Engineers has instructions to request an injunction from the federal court when ground is broken.

Brief News Notes

Pine Flat (Cal.) Conservation Project to Include 50,000-Kva. Power Plant.—It has been determined by the committee in charge of the Pine Flat conservation project in southern California, which involves the building of a dam in the Kings River, that a power plant to be rated at 50,000 kva. and cost about $3,000,000 shall be included in the scheme.

Georgia Commission Adopts Standard Utility Accounting.—The uniform system of utility accounts advocated by the National Association of Railway and Utilities Commissioners, with special forms for electric light and power companies, gas and street-railway companies, has been adopted by the Georgia Public Service Commission for use throughout the state.

Durham, N. C., to Develop Flat River.—The City Council of Durham, N. C., has approved plans calling for an expenditure of approximately two million dollars on a water supply and water-power plant on Flat River. Two plans were presented to the city by the engineers, one calling for a 58-ft. dam which would have supplied the city with its water needs, the other calling for a dam 85 ft. high to supply the city with water and generate electric power. This latter project was approved.

New Project for the Choctawhatchee.—Despite the injunction against the municipal project of Dotham, Ala., reported last week, the erection of a hydro-electric power dam on the Choctawhatchee River seems assured through the action of the Alabama Public Service Commission in granting a certificate of convenience and necessity for this purpose to the Houston Power Company. The dam will be 50 ft. in height instead of 30 ft. as was first planned. Bonds to the amount of $1,000,000 were authorized.

West Penn Buys Vandergrift Electric Company.—The West Penn Power Company has purchased the property of the Vandergrift (Pa.) Electric Light & Power Company, and eventually Vandergrift will be connected to the main transmission lines of the West Penn system, although for the present the new owners will continue to operate the local plant. The adjacent territory has been supplied with electric power by the West Penn organization for a number of years.

New Plant for Rock Island, Ill.—Ground will be broken this fall for a plant at Rock Island, Ill., for the People's Power Company, to cost $1,500,000, Manager E. B. McDonald announces. The equipment will include a 30,000-kw. steam turbo-generator. When the plant is complete it will have a capacity of 60,000 kw. The People's Power Company is controlled by the Tri-City Railway & Light Company, whose subsidiaries serve Moline and Rock Island, Ill., Davenport, Iowa, and other places.

Big Reservoir on Yadkin River Is Projected.—The Tallassee Power Company of Badin, N. C., is said to be planning the erection of a huge dam at High Rock on the Yadkin River, several miles above Badin. A basin covering about 30 square miles of territory is proposed, which will serve as a reservoir for water supply during periods of drought. The plant at Badin is able to operate only part time now because of low water, and it is to take care of this situation that the big reservoir is proposed.

Fire Menaces Seattle's Power System.—Flames which swept through timber in the Cedar River watershed and adjacent areas reached within 300 yards of the large hydro-electric station of Seattle's light department on Oct. 30, and vigorous action was necessary to save the light system from serious damage. The penstocks carrying water from Cedar Lake to the power station were saved by boring holes in the wooden-stave pipes, permitting water to flow over the outside of the pipes when the fire threatened the lines.

Educators Urge World Metric Units.—Worldwide adoption of the metric units of weights and measures was strongly urged at the World Conference on Education, recently held in San Francisco. The metric resolution was discussed in the group session on "greater unification in science," the committee in charge being Y. Ishimura (for Asia), Dr. Maria de Maetzu (for Europe) and Percy E. Rowell, chairman (for America). Passage of the metric standards bill which will be again introduced in the new session of Congress to convene in December was advocated.

Electric Vehicle School Lectures to Be Published.—Because of the widespread interest in the Electric Vehicle School lectures which were presented at the sessions of the school held in New York, Chicago and more recently in San Francisco it has been decided to publish them in book form. Already

more than a thousand copies of this book have been ordered. The cost of the complete set of twelve lectures will vary from $1.50 to $2, depending on the number ordered. Charles R. Skinner, Jr., chairman Electric Transportation Bureau, N. E. L. A., is in charge of the publication.

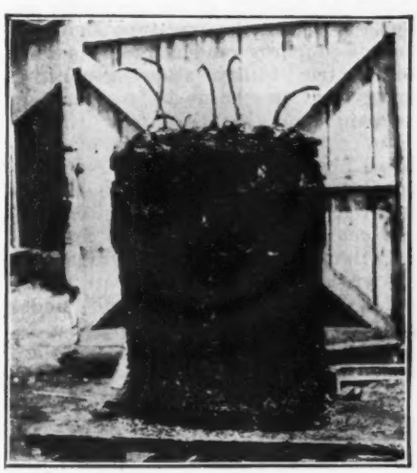
International Character of Pigeon River Development.—The proposed plan of the Pigeon River Lumber Company of Wisconsin Rapids, Wis., to erect five power houses at points within a distance of 15 miles on the Pigeon River to develop 25,000 hp. has been temporarily halted pending approval of the project from the Canadian government. In a decision handed down by the Federal Power Commission at Washington it was ruled that owing to the fact that the Pigeon River flows into Lake Superior from the Province of Ontario, making it an international stream, the project cannot be started until the sanction of the Canadian authorities is obtained.

Transmission Line Crosses Sierra Nevada Mountains—The 60-kva. transmission line 50 miles in length tying in the system of the Truckee River Power Company with that of the Pacific Gas & Electric Company has recently been completed. The line, which was described in the ELECTRICAL WORLD for May 19, page 1165, crosses the Sierra Nevada Mountains at an elevation of 7,300 ft. and, owing to the severe winter storms, heavy construction was necessary. The new line has a capacity of 7,500 kva. and will give the Truckee River Power Company additional power for supplying its mining and other load in Nevada.

Peninsular Power Company Increases Capital.—To meet the financial requirements of its proposed plan to make extensive additions and extensions to its plant and outside properties, the Peninsular Power Company, which operates several hydro-electric properties in northern Wisconsin and the upper peninsula of Michigan, furnishing light and power service to iron-mining companies and cities, has taken steps to increase its capital stock from $3,000,000 to $4,500,000, for which state consent has been received. The preferred stock will thus be increased from $1,500,000 to $3,000,000.

Growth of Service in Los Angeles.—During the past twelve months, according to Chief Electrical Engineer Scattergood of Los Angeles, the city's power bureau has constructed 195 miles of electric lines, each line carrying a large number of high-voltage wires. The construction of new lines and improvements of existing lines has necessitated the setting of 9,500 poles in the city. To meet new demands for commercial, industrial and domestic power and lighting service, the bureau is installing on an average 100 new meters and services each day. Within the past twelve months more than 28,000 electric services, or enough to serve a city of 100,000 people, have been installed by the bureau.

Transformer Runs for Eighteen Years Without Overhauling.—Eighteen years of continuous service and still going strong is the record credited to the 20-kva., 10,000-volt General Electric transformer shown in the accompanying illustration. It was recently sent to a local warehouse from the Fullerton district of the Southern California Edison Company, which originally purchased it, marked "no longer needed in district." In spite of its condition, which was then unknown, the apparatus successfully withstood potential tests before being sent to the shop with instructions to "clean and paint." When the transformer case was removed the sludge at the top resembled coke and was knocked



off with a hammer. At the bottom it looked like axle grease. Records of the Pittsfield factory of the General Electric Company show this machine was tested in January, 1905.

Electric Smelter for Denver Advocated.—Frank E. Shepard, president of the Denver Engineering Works, is endeavoring to vitalize the project of establishing an electric smelter in that city. The possibilities, he says, are incalculable. "Norway and Sweden for years have been treating ores electrically for $3 a ton," Mr. Shepard asserts. "Here in Denver the cost would probably be $10 a ton, because of the higher cost of power, but this would permit the treatment of fifteen-dollar ore at a profit of $5 a ton, after all freight and smelting cost had been paid."

Northern Illinois Company Purchases Interurban Public Service.—The Public Service Company of Northern Illinois has announced purchase of the Interurban Public Service Company, an electric utility serving the towns of Roselle, Bloomingdale, Cloverdale, Itasca, Wooddale, Meachan, Shaumberg, Bartlett and Ontarioville. These communities, which will add about 1,800 customers to the lines of the Northern Illinois company, are about 25 miles west of Chicago and are now being served from a central generating station at Roselle. It is the purpose of the purchasing company to build 66,000-volt lines to serve them. The acquisition of this property closes the gap of the outer belt line of Chicago between the northern and southern extremities of the territory now served by the Public Service Company of Northern Illinois.

Associations and Societies

Lehigh Valley Section, A. I. E. E.—This section will meet at the Schuykill Valley Country Club, Pottsville, Pa., on Nov. 16 and 17. C. A. Hall, general manager of the East Penn Electric Company, and engineers of the J. G. White Corporation will describe the new plant at Pine Grove.

American Electrochemical Society.—This society has already made plans for its next meeting, to be held on April 24, 25 and 26, 1924, in Philadelphia, with headquarters at the Bellevue-Stratford. There will be two symposiums, one on "Recent Progress in Electrodeposition," S. Skowronski, Perth Amboy, N. J., chairman, and the other on "Organic Electrochemistry," C. J. Thatcher, New York City, chairman.

Coming Meetings of Electrical and Other Technical Societies

[A complete directory of electrical associations is published in the first issue of each volume. See July 7 issue, page 56, for latest list.]

Electrical Supply Jobbers' Association—Hotel Statler, Buffalo, Nov. 12-15. Franklin Overbagh, 411 South Clinton Street, Chicago.

Electrical Manufacturers' Club — Hot Springs, Va., Nov. 14-18. F. L. Bishop, Hartford Faience Company, Hartford, Conn.

Arkansas Utilities Association—Pine Bluff, Nov. 15-16. R. I. Brown, Little Rock Railway & Electric Company, Little Rock.

Electric Power Club—French Lick Springs Hotel, French Lick, Ind., Nov. 19-22. S. N. Clarkson, B. F. Keith Bldg., Cleveland.

Southeastern Division, N. E. L. A.—Hillsboro Hotel, Tampa, Fla., Nov. 19-22. Charles A. Collier, Georgia Railway & Power Company, Atlanta, Ga.

Electrical Credit Association, Central Division—Hotel LaSalle, Chicago, Nov. 20-21. F. P. Vose, 1341 Marquette Bldg., Chicago.

Commercial National Section, N. E. L. A.—Group meetings, Salt Lake City, Nov. 21-22.

Empire State Gas and Electric Association—Electric Section, Edison Club, Schenectady, Nov. 21-22.

American Physical Society—Ryerson Physical Laboratory, Chicago, Nov. 30-Dec. 1. H. W. Webb, Columbia University, New York.

American Society of Mechanical Engineers—New York City, Dec. 3-6. C. W. Rice, 29 West 39th St., New York.

National Association of Railway and Utilities Commissioners—Miami, Fla., Dec. 4-7. J. B. Walker, New York Transit Commission, New York City.

American Engineering Council (F. A. E. S.)—Washington, Jan. 10-11. L. W. Wallace, 26 Jackson Place, Washington.

American Institute of Electrical Engineers—Midwinter convention, Philadelphia, Feb. 4-8. F. L. Hutchinson, 33 West 39th St., New York.

Commission Rulings

Rules of a Commission Are Not to Be Adopted in Part Only.—The Illinois Commerce Commission has forbidden the United Utilities Company of Lena, Ill., to pick out certain sections of an order of the commission relating to the establishment of credit for its customers and has ordered the company to adopt the rules in their entirety inasmuch as they cover a comprehensive policy in regard to credits.

Monopoly and Failure to Serve.—Petition was made to the Connecticut Public Utilities Commission that the United Illuminating Company of New Haven be compelled to make an extension of its lines for two miles to serve a would-be customer residing in the town of Fairfield, or that, failing this, it relinquish its charter right in the town and another utility be allowed to come in. The commission denied the plea, holding, first, that an extension of utility service should not be ordered when there is not a reasonable demand for the extension and the probability of a reasonable return, and, second, that it has no power arbitrarily to authorize a utility to enter a territory for which another utility holds the charter because the latter cannot or will not make an extension.

Original and Reproduction Cost.—The Public Service Commission of Louisiana, holding that it is not its province or right to disregard or refuse a consideration of any fundamental basis for establishing valuation, took issue with the Shreveport Railways Company's contention that the commission was restricted, in its determination of the value of property devoted to public service, to the testimony appertaining to a physical appraisal of the company's property on the basis of the reproduction cost new under present prices less depreciation. Although it held that reproduction cost is to be considered as one of and along with the other elements to determine a fair value, the commission concluded that the original cost of the property was material and necessary to a determination of the case.

Standby Equipment Frequently Used Should Be Included in Rate Base.—In a valuation of the property of the Martinsville Gas & Electric Company, the Indiana Public Service Commission ruled that any part of a generating plant actually used during interruptions of service over a transmission line should be included in the rate base of an electric utility where such interruptions are frequent and for prolonged periods. In the case under consideration the company procured its energy from another utility over the latter's high-tension line but had retained its own old generating plant as a reserve. If, the commission said, the service from the other company was perfect there would be no reason to include the old plant in the appraisement; but investigation had shown that the purchased service was not dependable and that it was necessary for the greater part of the Martinsville company's standby equipment to be maintained if the company was to furnish adequate and continuous service.

Amortization of Unused Property—Discrimination. — In fixing electric rates for the Martinsville Gas & Electric Company, the Indiana Public Service Commission ruled that that portion of a standby plant which is not used and useful should be eliminated from the rate base, that a sufficient amount should be allowed as an operating expense to permit the long-time amortization of property rendered useless when an electric utility stops generating energy and purchases it from another company, and that the proper amount to be amortized in the case of abandoned property is the cost of reproduction less depreciation less the salvage value. Special contracts according certain consumers reduced rates are illegal, the commission ruled further in this proceeding, and render both utility and consumers liable to a penalty under the Indiana law. Discrimination, it asserted, exists when demand charges are made for power loads and no energy charges are made, when parties having both lighting and power loads are billed only at the power rate, and when parties having lighting loads are billed on the power schedule.

Relation of Rates and Service. — In denying the application of the city of Los Angeles for a reduction of rates by the Southern California Telephone Company, on the ground of poor service, the California Railroad Commission said: "Rates cannot be determined on a consideration of relative service conditions only, although the quality of service rendered must have a bearing upon the compensation to be paid therefor. Other factors, such as operating revenue from present rates, operating expenses, resulting return on a reasonable investment or rate base and the practical conditions under which the utility is operating, must be considered. . . . On the other hand, the company has assumed an obligation to render adequate and efficient service in the Los Angeles territory. If for any reason it has failed to keep pace with the phenomenal growth and development of that territory and now finds itself in a position where it must practically rebuild its entire facilities under conditions which necessarily interrupt and reduce the efficiency of the service, it must not expect the ratepayers to assume all the burdens and save the company from the result of its own lack of foresight or enterprise."

Recent Court Decisions

Provision of Illinois Utility Law Declared Void.—In a street-railway grade case (Illinois Commerce Commission ex rel. City of Bloomington vs. Cleveland, Cincinnati, Chicago & St. Louis Railway Company), the Supreme Court of Illinois declared that the provision in the public utilities act that "the decision of the commission shall not be set aside unless it clearly appears that the finding of the commission was against the manifest weight of the evidence" is void as an attempt to prescribe a rule governing judicial action and determination, in violation of the state constitution. The court held, however, that all doubts as to the propriety of means or methods used in the exercise of the powers clearly conferred on the Commerce Commission should be resolved in favor of its action, and there should be ascribed to its decisions the strength due to the judgment of a tribunal appointed by law and informed by experience. (140 N. E. 868.)*

Revaluation of Potomac Electric Power Company Ordered. — Under a decision rendered by the District of Columbia Supreme Court, that body will revalue the properties of the Potomac Electric Power Company, using as a basis the valuation data gathered in 1916-17 by the Public Utilities Commission, unless the company appeals from the decision and causes further litigation. The litigation has been before the courts several years, and meanwhile a fund which now exceeds $4,000,000 has accumulated through impounding of the difference between the rate collected for electrical energy—10 cents—and the rate fixed by the commission, which has been changed several times during the litigation, varying from 8 cents to nearly 9 cents. The commission fixed a valuation on the company's properties for rate-making purposes and announced its decision in 1918, reducing the rates, whereupon the company appealed to the courts, alleging that replacement values had not been allowed by the commission on existing prices and also that some items had been excluded erroneously. The District Supreme Court denied the injunction; the District Court of Appeals reversed this action, and the United States Supreme Court refused to take jurisdiction last spring, thus allowing the reversal of the Court of Appeals to stand. The company then contended that the entire valuation work must be done over, while the commission contended that the District Supreme Court had the authority to make a revaluation from the old records. This contention is upheld.

*The left-hand numbers refer to the volume and the right-hand numbers to the page of the National Reporter System.

Men of the Industry

Changes in Personnel
Accomplishments, Responsibilities, Honors, Appointments and Activities of Men Engaged in all Branches of the Electrical Industry

W. H. Patchell, British consulting engineer, who has been spending some time in this country, departed for England on Tuesday, Nov. 6.

H. R. Whiting has resigned as superintendent of steam plant and substations of the Porto Rico Railway, Light & Power Company, San Juan, to become superintendent engineer with the Compañia Electrica de Santo Domingo, Santo Domingo.

D. C. Smith, for seven years manager of the Fort Smith (Ark.) Light & Traction Company, has resigned to become affiliated with the Byllesby Engineering & Management Corporation of Chicago, operating manager of the Fort Smith properties.

Frank H. Golding, district manager of the Federal Electric Company, Buffalo, and for some years associated with various Insull properties in the Middle West in an executive capacity, has been appointed general manager of the Cambridge (Mass.) Electric Light Company, succeeding the late Welles E. Holmes.

Prof. Vladimir Karapetoff of the school of electrical engineering, Cornell University, has been awarded a prize of four thousand francs by the Montefiore Foundation of the University of Liège, Belgium, for his kinematic computing devices of electrical machinery. Descriptions of these devices have appeared in the technical press during the last three years.

M. R. Frederickson, who has been in charge of the Wisconsin Valley Electric Company's properties at Tomahawk as division manager for the last few years, has been promoted and transferred from that city to take over the duties of commercial manager at Wausau.

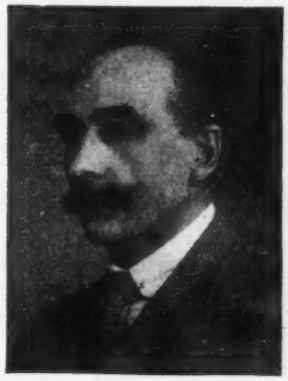
E. V. Pryor, who has been manager of the commercial department of the Wisconsin Valley Electric Company for more than six years, has severed his connection with that company to take charge of the merchandising department in Oakland, Cal., of the Altofer Brothers Company, manufacturer of the A B C electric washing machine.

Frank W. Smith, vice-president of the United Electric Light & Power Company, New York, has been made chairman of a committee of representative leaders in the gas and electric interests in New York formed to co-operate with the Red Cross in its annual roll call, opening Armistice Day, Nov. 11, and continuing until Thanksgiving.

Gerard Swope, president of the General Electric Company, was the first Aldred lecturer at the Massachusetts Institute of Technology, Cambridge, on Nov. 9, the opening day of the course. These lectures have been established by J. E. Aldred of Baltimore and New York, who has been responsible for similar lectures bringing leaders in science and industry into other educational curricula, thus tying the interests of engineering students more closely in with those of the business world.

Roger T. Smith, Electrical Engineer of Great Western Railway

Roger T. Smith, electrical engineer of the Great Western Railway, London, since 1905, received his scientific training at University College, London. Soon after his graduation he went to India and supervised the installation of waterworks pumping machinery for five large Indian cities. Returning to London, he spent the year 1894 with the Westminster Electric Supply Corporation as resident engineer at the Davies Street generating station, and for the next three years he was technical manager for the Imperial Continental Gas Association of La Compagnie Electrique Anversoise (Antwerp, Belgium). He joined the staff of Sir Alexander Kennedy, consulting engineer, in 1898 and in 1902 was sent to Buenos Ayres as Sir Alexander's representative on a large electric railway scheme. When he returned to England he was placed in charge of the electrification of the Great Western Railway, London District, and on the completion of that work he became identified with the railway company as its electrical engineer.



R. T. SMITH

Mr. Smith is a past-president of the Institution of Electrical Engineers, a member of the Institution of Civil Engineers, the Institution of Mechanical Engineers and the American Institute of Electrical Engineers.

M. L. Kachel, who has been with the sales department of the Northern States Power Company for the last five years, has been appointed manager of the Minot (N. D.) division of the company.

R. M. Rankin of the lighting engineering department of the General Electric Company at Schenectady, will spend six months with the Portland (Ore.) Railway, Light & Power Company as exchange engineer.

W. P. Hendricks, for a number of years associated with the William A. Baehr Organization, consulting engineers, Chicago, is the new purchasing agent for the Illinois Power & Light Corporation, with headquarters at Chicago.

R. R. Robley, operating engineer of the Portland, (Ore.) Railway, Light & Power Company, recently left Portland for the Schenectady works of the General Electric Company, where he will spend six months studying engineering problems. Mr. Robley was chosen by the Portland company to represent it on a personal exchange plan by which the two firms exchange two engineers for six months.

Harry J. Vance, purchasing agent for the Illinois Power & Light Corporation with headquarters at Peoria, Ill., has been made purchasing agent for the Illinois Traction, Inc., with headquarters at Chicago. Mr. Vance is well known throughout Illinois, having been for many years purchasing agent for the Illinois Traction System, which became a subsidiary of the Illinois Power & Light Corporation last June.

Edward Woodbury has recently been appointed electrical engineer of the Merced Irrigation District on powerhouse design and construction for the consulting engineers on the project. He was formerly connected with the installation of the hydraulic and electrical features of the Pit River power house.

Obituary

Ralph E. Rugh, for many years vice-president of the Western Coil & Electrical Company, electrical equipment manufacturer of Racine, Wis., died recently at his home in that city.

Michael B. Ryan, inventor, died at his home at Milford, Conn., on Wednesday, Oct. 31, following a week's illness. Mr. Ryan, who was sixty years old, was known as the inventor of the automatic electric chain-welding machine.

Jeremiah W. Clapp, treasurer of the Memphis (Tenn.) Power & Light Company, died at his home in Memphis on Nov. 1 after an illness of several months. Mr. Clapp was seventy-one years of age.

William F. Wendt, founder and former president of the Buffalo (N. Y.) Forge Company, died at his home in that city on Tuesday. Oct. 30. Mr. Wendt, who was a brother of the present president, retired from the company in 1916. He was sixty-five years of age.

Manufacturing and Markets

Devoted to the Discussion of Business and Economic Problems of the Producer and Distributor, with Market Reports, Trade Activities, Foreign and Construction News

A Super-Standard Electrical Code—the Underwriter's Viewpoint*

The Proportion of Electrical Fires—Would Super-Standard Soon Become New Minimum Standard? — Improvement Should Be Sought Through Strengthening the Present Code

By F. J. T. Stewart,
Superintendent Bureau of Surveys, New York Board of Fire Underwriters

IT HAS been pointed out that fire insurance companies regard electricity as an important fire hazard, and that under the operation of the present National Electrical Code an important percentage of the total annual fire loss is due to electricity. It is contended, therefore, that super-standard installations should appreciably reduce this loss and justify special recognition by underwriters. If this conclusion is correct, it must be predicated on the assumption that the electrical fires have occurred largely in equipments installed and maintained in full compliance with the present code.

Ratio of Electrical Fire Losses to All Losses

An analysis of electrical fires shows that most of them do not originate in standard installations, but in such as are defective, usually as the result of improper installation, deterioration and neglect, or from misuse, as in the case of electric pressing irons, improper fusing, etc. In fact, a nine-year summary of the results of detailed investigations of fires in New York by the electrical department of the New York Board of Fire Underwriters shows that out of a loss of $1,614,338 the cause of which was definitely established as electrical, only 21 per cent was caused by fires in equipments which, according to the records, were in compliance with the requirements of the National Electrical Code. Some part of this small percentage must also be charged to the misuse of such standard equipments and to possible deterioration. The balance, amounting to 79 per cent of the losses due to electricity, occurred in equipments known to have been defective.

The fire loss due to electricity has been characterized as an inportant percentage of the total annual fire losses. We should first of all determine whether or not the electrical loss is sufficiently large to justify a super-standard electrical code and special recognition of the reduced fire hazard to be expected from compliance therewith. The records of the National Board of Fire Underwriters, which have been comprehensively compiled with care for the last five years, show that the annual fire loss from electrical causes during that time was 5.3 per cent of the total. These figures have been criticised by electrical statisticians of the Society for Electrical Development, who after an extensive investigation estimate that the electrical losses are less than one-half of this amount, or, to be exact, 2.57 per cent. I have already shown you records indicating that less than 21 per cent of the electrical losses have occurred in standard equipments intelligently used. Therefore, 21 per cent of 5.3 per cent gives 1.1 per cent of the total annual fire losses as the amount due to fires in standard electrical equipments based on the insurance records, or less than 0.55 per cent based on the estimate of the electrical statisticians.

Cost Would Exceed Savings

If the exact amount of the electrical losses due to standard installations lies somewhere between these two estimates, it must be evident that the cost of preparing and applying a super-standard electrical code to save at the best some portion of this loss, amounting to only a fraction of 1 per cent, is hardly worth while. Certainly no degree of recognition would be justified that could be a determining factor of a super-standard equipment. The cost to the electrical industry and the underwriters of preparing such a standard, applying it and giving credit for such a small degree of difference in the fire hazard would greatly exceed the saving, even if the electrical loss could be reduced to zero thereby, which of course would be impossible, as misuse and deterioration will always cause some fires.

Detailed specifications for a super-standard equipment would only constitute another set of minimum requirements to secure a different classification, and it could never be made so high as to include all the abnormal precautions which a limited number of persons are sometimes willing to take. Anxiety to avoid interruption and disorganization of a highly profitable business and to go the limit in safeguarding life are the most likely motives for providing extreme safeguards rather than a relatively small insurance reduction.

Would Become New "Minimum Standard"

After the establishment of a super-standard there would be at once a tendency to make its provisions a part of the ordinary standard. It would weaken respect for the present code. Municipal authorities, eager to do their duty in safeguarding lives and property against this mysterious hazard, would "play safe" by enacting the super-standard into law, either in whole or in part. In fact, the laws in some cities now include certain requirements which would probably be suggested as part of a super-standard, such as conduit work to the entire exclusion of knob and tube work.

Even on this point there is chance for considerable argument as there are certain situations where the open work is concededly preferable to conduit work, notably in cold storage rooms and places containing corrosive vapors. There are also some who prefer and encourage open work in all locations where there is no great danger of mechanical injury to the wires.

If a super-standard were adopted

*A paper presented before the Association of Electragists International, Washington, D. C., Oct. 12, 1923.

and a considerable number of installations were made in compliance therewith, merely for the insurance recognition, much confusion and friction would result, provided extensions or alterations were made without ascertaining in advance that an installation is in the super-standard class when such is the case. It would complicate the electrical business to the extent of making investigation necessary in each case to know what standard should govern any extensions or alterations. Experience already gained in a few cases where especially stringent requirements have been enforced shows that friction has occurred, because it was assumed that the usual requirements were to apply and extensions were made accordingly.

General Basis of Rates

The increased safeguards to electrical installations which are being added from time to time and intended primarily for the protection of life all tend in the aggregate to strengthen the protection against fire. They also teach caution and a more intelligent and careful use of electrical equipments. These considerations may be counted upon further to reduce losses by fire below the present relatively small amount in buildings having installations that are in compliance with the present code.

Most insurance schedules start with a base rate which is intended to include the collective losses resulting from commonly found fire hazards which have been protected by reasonable safeguards. Thus, it is frequently found that no specific penalty is provided for fire hazards due to lighting, heating, hot ashes, electricity, matches, smoking, etc. Accordingly, it often happens that no cognizance is taken of a standard electrical lighting installation in a building, as compared with the absence of electricity altogether. This attitude is based on the conclusion that the losses on fully standard electrical installations are so small that they do not justify the cost of applying a small charge in every building. Theoretically, of course, there should be some charge for an electric lighting installation, as in the long run the presence of any electrical installation, however well safeguarded, is going to add something to the fire hazard as compared with no artificial light whatever. It may therefore seem that, because of the practical considerations involved, the electrical industry is already being favored in the cases where no attention is called by any penalty in the insurance schedule to the fire hazard incident to a standard electrical installation.

Better Off Without a Super-Standard

From the strictly rating point of view, the most important objection is that the establishment of such a practice as is sought in this connection would constitute a precedent that would have to be followed in many other and quite different connections, so that, for instance, we would have a super-standard for acetylene, city gas, fuel oil burning equipments, internal-combustion engines, fire alarms, sprinklers, fire windows, etc. Any thorough-going practice of that kind is physically impossible because of the multiplicity of cases that would arise and the minute differentials that would have to be figured in literally thousands and thousands of risks.

In so far as the fire hazard is concerned, I am convinced there is no occasion for a super-standard code. From the standpoint of the electragist anxious to do only the highest grade of work, I believe he is better off without the super-standard—another minimum requirement. It would encourage the cheap and irresponsible type of contractor to undertake high-grade work to put a super-standard in his hands. At present the field is wide open to give good salesmanship, lighting efficiency, artistic effects and high-grade work a chance to win out by appealing to higher instincts of human nature rather than to a relatively immaterial difference in the degree of fire hazard, even if this difference justified the expense of analyzing it. Most manufacturers, including even makers of fire-extinguishing equipments, aim to avoid a situation where the chief consideration influencing a sale is whether or not the insurance recognition yields an attractive return on the cost of the article to be sold—they endeavor to make their appeal rather a gain in safety.

Present Code High Standard

The present electrical code is already a high standard. This opinion, I think, has been confirmed by the record of fire losses with standard equipments already quoted. If the code is occasionally strengthened when experience develops weaknesses, we can feel reasonably certain that there will be no necessity for a super-standard, with all the expense, complications and annoyances resulting from two standards, the enforcement of which must of necessity be arbitrary and 100 per cent complete in order to place the equipment in one class or the other.

Comprehensive reinspections at more frequent intervals would, in my opinion, do more to reduce the electrical fire loss than a set of super-standard requirements. The fire records already quoted confirm this conclusion, showing as they do that about 80 per cent of the electrical fire loss results from defective equipments and is therefore preventable under the present code by proper care and maintenance.

Strengthens the Present Electrical Code

Even should electrical fire losses in standard equipments ever show the need of better safeguards, it seems as if you must agree that a strengthening of the standard will be essential rather than the creation of another or super-standard. You cannot afford to go ahead electrifying America under a minimum standard that may be weak enough to leave a chance that electricity will figure as the worst of all fire hazards. Gentlemen, you are steering the electric industry toward dangerous ground if you work for a so-called super-standard of safety instead of bending your energies to strengthening the National Electrical Code so that it will always represent a full measure of reasonable safety that will shield your wonderful product from the possibility of becoming a notorious firebrand.

There is no parallel in the safeguarding of fire hazards in any other line of business to compare with the dual standard of safety as proposed for electricity. You would at once be confronted with the question, "Why the minimum standard if the super-standard affords a measurably better degree of safety against fire?" Inevitably, any admission that the difference in fire hazard is measurable amounts to a confession that the minimum standard is too weak; in other words that it is sub-standard. You are proposing to risk the good name of electricity as a safe product to bring about a condition whereby the fire insurance companies will finance the purchase of really safe installations. It seems that this would inevitably lead to a most unwholesome situation for all concerned.

Business Conditions

A Survey of Important Developments in the Electrical Market Including Data on Production, the Sales Outlook, Credits, Exports, the Metals and Other Conditions Affecting Cost, Supply and Demand

APPLIANCE selling holds the center of the field in the electrical trade this week. In all parts of the country demand is strengthening, and manufacturers are reporting a heavy call for the full line of electrical comfort and labor-saving appliances that are suitable for Christmas gifts. Jobbers are devoting a large share of their attention to this holiday trade. The prevalent feeling seems to be that sales this year are going to set a new record for the electrical industry.

The general tone of business in the East is better this week. Boston, Philadelphia and Atlanta experienced a stronger general demand, though in the New York district porcelain, conduit, wire and wiring devices generally were slack and the market was characterized as spotty.

In the Middle West general business was steadier, although sales in either the Chicago or the St. Louis area were not large. There was a slight reduction in the price of wire and pole-line hardware reported in St. Louis. Conduit and wire were selling better in Chicago than the week before. Business on the Pacific Coast continues in good volume with prices steady. Orders from Japan to the lumber and other industries continue to influence considerable buying of electrical material. Throughout the country sales of radio material are steadily increasing.

Many Electrical Machinery Makers Reported Deficits in 1921

OF THE 572 corporations in the United States engaged in the general manufacture of electrical machinery, including stationary and marine equipment and refrigerating apparatus, during 1921, the Bureau of the Census reported late last week that 383 reported no net income and the total showed deficits aggregating $20,348,361. Of the total corporations, 189 had net incomes aggregating $34,289,413, on which they paid a total tax of $4,089,018.

New York State Electrical Factory Earnings Now $31.88

WEEKLY earnings of workers in the electrical manufacturing factories of New York State during August were at the average rate of $31.88, according to a bulletin just issued by the Industrial Commissioner at Albany. The average weekly earnings of these workers in the factories of New York City amounted to $22.29, according to the report, with those of the territory outside of New York City receiving an average of $32.90.

The course of employment in representative electrical manufacturing establishments in New York State showed a decrease in the number of employees from July to August of 0.1 per cent, compared with an increase from June to July of 1.9 per cent, and compared with an increase from August, 1922, to August, 1923, of 18.6 per cent. Amount of payrolls from July, 1923, to August, 1923, increased 0.3 per cent, compared with an increase of 2.1 per cent for July over June, 1923, and with 41.4 per cent for August, 1923, over August, 1922.

Signal Apparatus Shows Improved Design and Better Market

SIGNAL equipment business may be said to have been placed on a considerably higher plane during the last three months. A better supply of raw material and skilled labor has become available and has naturally improved the ability of manufacturers to make deliveries and effected economies that have been reflected in more satisfactory profits. This, of course, has relieved the stress all along the line. At the same time the market has strengthened materially and jobbers' stocks are moving well, so that the tendency toward price cutting that crept into the situation a month or two ago has been relieved. There has been distinct progress made also in the improvement of types of signal apparatus that go into apartment houses and school installations.

New designs for apartment houses and school call telephones include no receivers that can be removed by that class of radio enthusiasts who have taken so many of them for use on radio sets. The trend is toward the hidden loud-receiver attachment which is within the telephone box itself. Moreover, there is an absence of shiny brass and copper parts in the newer equipment, designers supplying the dull black and colored enameled styles, which are easily cleaned.

Although the largest field for signal equipment remains in the apartment-house installations, the schools are taking surprisingly large amounts of all sizes of signal lamps, bells, buzzers, telephones, heat-recording apparatus, etc. The schools of New England, whose organization is recognized as the highest in the country, lead in the consumption of this material; New York schools are second, and Middle Western schools are taking the third greatest amount.

A surprising volume of signal apparatus is being used today in the average grade school of forty rooms, where only five years ago its use was generally limited to a few classroom bells in the halls and there were practically no telephone or call systems in the teachers' or principals' rooms. Today the modern school of forty rooms is equipped with between thirty and forty telephones, as well as call systems, forty classroom bells, fire alarms, signal lights for teachers and great areas of switchboards for operation of this equipment from almost any floor in the building.

October Electrical Imports Showed Gain of $35,245

IMPORTS of electrical apparatus, machinery and supplies through the port of New York during October show a surprising increase in value. The total of last month's imports was $83,052, an increase of $35,245 over September, when the figure was $47,807. Germany again led in the value of most of the commodities that are also sent in by her only important competitors, England and France. The totals for these countries during October are as follows: Germany, $41,842, in September $18,732; England, $21,080, in September $13,510, and France, $15,836, in September $11,653. The highest value in the table of information just issued by the Department of Commerce was for cable instruments imported into this country by England and amounting to $13,513. France and Germany sent no cable instruments during October. The second highest value in the import list is that for radio apparatus sent by Germany and amounting to $13,025.

Included under classifications in the list are many other items of interest to American electrical manufacturers. Germany sent $2,234 worth of hair driers, and there is no indication that any other country tried to secure any of that business. Germany also sent $3,186 worth of plugs, $7,797 of carbons, $855 of dry batteries, $10 of vacuum cleaners, $1,469 of reflectors, $4,323 of fixtures, $94 of perfume burners, $1,240 of electric stoves, $3,319 of table lamps and $1,242 of sockets. England sent $2,750 worth of radio apparatus, $2,814 of carbons, $620 of lighting fixtures, $535 of electric stoves, $838 of floor lamps and $10 of storage batteries. France sent $6,151 worth of carbons, $4,679 of fixtures, $1,727 of table lamps, $19 of electric signs, $10 of insulators, $3,190 of electric fountains, $40 of projectors, $10 of X-Ray apparatus and approximately $10 worth of hat pressers.

Details of Census on Lighting Fixtures in 1922 Announced

ANNOUNCEMENT is made by the Department of Commerce that returns received from 521 establishments engaged in the manufacture of lighting fixtures show products to the value of $76,402,000 during the year 1922. This special report is the first of an annual series and was made by the Bureau of the Census at the request of the manufacturers and associations representing the industry. Schedules were mailed to all establishments which reported the

manufacture of electric and gas fixtures, lamps and reflectors, and shades for the 1921 census of manufactures, and to others presumed to have manufactured lighting fixtures in 1922, whose names were obtained from trade directories.

Lighting fixtures reported in the following table are arranged in five main groups, according to the purpose for which the fixtures are to be used, namely, commercial, residence, industrial, street and marine lighting, followed by the auxiliary group "shades," as representing component parts of the complete fixtures. It will be seen by reference to the following table that the value of residence lighting fixtures constitutes 54.5 per cent of the total value of products reported. Of the 521 establishments reporting lighting fixtures, 254 manufactured home lighting fixtures, 178 manufactured table and floor lamps, and 109 manufactured reading lamps. The next group in importance

MANUFACTURE OF LIGHTING FIXTURES DURING 1922

Class of Product	Number of Establishments Reporting	Value
Total	...	$76,402,193
Commercial lighting fixtures	...	7,267,941
Auditorium	67	1,825,390
Operating and hospital	41	492,013
Orchestra	14	125,525
Store	105	3,058,213
Window and showcase	40	1,246,321
Stage	25	520,479
Residence lighting fixtures	...	41,621,505
Home lighting	254	24,234,471
Table and floor lamps	178	12,222,814
Reading lamps	109	5,164,220
Industrial lighting fixtures	...	7,718,846
Adjustable	13	311,005
Car	16	2,087,358
Office and drafting room	36	1,658,494
Desk lamps	23	291,811
Factory or industrial	46	3,370,178
Street lighting fixtures	22	3,948,308
Marine lighting fixtures	22	525,678
Shades	...	15,319,915
Glass	69	8,105,068
Parchment, paper and celluloid	28	310,299
Silk, cretonne, linen or other fabric	82	6,379,553
Tin, aluminum, brass or other metal	14	517,995
Reed, rattan or other wooden form	2	7,000

is shades, with a product of $15,319,915, or 20 per cent of the total value reported for lighting fixtures. In this group the leading class is glass shades, with a product of $8,105,068 in sixty-nine establishments.

Reports were received from twenty-five establishments, with a total product of $10,509,645, divided as follows: Automobile lamps, $9,258,984; incandescent electric lamps, $573,999; miners' lamps, $342,103; bicycle lamps, $154,371; lanterns, $94,476; electric locomotive headlights, $75,000, and wagon lamps, $10,712.

These establishments were excluded from the accompanying table for the reason that the products reported were not considered to be lighting fixtures within the meaning of this investigation.

Spotty Conditions Prevail in New York; Wire Falls Off

ALTHOUGH several new developments indicating a heavy demand for important commodities are features of this week's New York electrical market, a few lines are selling in less volume and with slightly lower prices. Jobbers call the situation spotty and hope for increases before the end of November. Those wholesalers specializing in washing machines, heating appliances and novelties report the best holiday season in their histories and state that shipments from the factory are far below normal deliveries. On the other hand, conduit, porcelain, wires and wiring devices are not moving as actively, and there is a tendency toward soft prices in all these lines, with a 2 per cent falling off in No. 14 rubber-covered. Lamp cords are firm. Stocks of these lines are in excellent condition.

In general, jobbers and manufacturers are marking time and are waiting for a settlement of the market for the heavier materials which is expected to come after inventory taking is finished. There is a feeling in the trade that the greatest buying of electrical materials and supplies was made during the heavy rushes of October and that the dealers and contractors are sufficiently supplied for present needs.

Wire and Conduit Markets of Philadelphia Still Weak

ACCORDING to reports received from the Philadelphia territory, a good demand for electrical goods is reported by the dealers. Sales of radio material, in particular, have increased, and labor-saving devices are in better request than they were a month ago. Almost all orders booked are for delivery within sixty days, although a few are up to and beyond ninety days. Stocks of finished goods are moderate, in some cases even light, and they have changed but little from those on hand at this time last month. Prices in general are unchanged, with the exception of those on copper wire and rigid conduit, which are lower and are still weak.

The demand for electrical contracting work has become brisker with the advent of colder weather, and labor in the Philadelphia territory is considered adequate, although one firm reports a scarcity of skilled workers. According to reports received from thirty-five manufacturers of electrical machinery and apparatus in Pennsylvania, New Jersey and Delaware, the number of wage earners during September showed a noticeable increase over that of August. The following table gives employment data for each of the two months, the number of firms reporting being thirty-five:

	Week Ending Sept. 15	Week Ending Aug. 15	Per Cent Change
Number of wage earners	12,881	12,477	+3.2
Total wages	$313,390	$299,709	+4.6
Average weekly wage	$24.33	$24.02	+1.3

New England Optimistic on Farm-Lighting-Set Sales

CONTRARY to the general feeling in the South and West, reported here a few weeks ago, representative opinion in farm-lighting-set manufacturing and distributing circles throughout New England is to the effect that 1923 will roll up an excellent total of business in this line. One large house, which set a bogey of 30,000 units at the beginning of the year, expects to market these by Dec. 31. All through the year deliveries have been satisfactory with the exception of the late winter period, and in some localities where sales representatives were greatly handicapped last winter by heavy snowfalls plans are now being made for the use of gasoline-driven snow sleds, these having been developed to a high degree of efficiency of late. A vigorous drive will be made this winter in this section for farm-lighting business, with the idea of taking full advantage of the "indoor" season in the country districts, when the salesman who penetrates to remote localities is often warmly welcomed by the prospective customer. Prices have been steady of late on representative units; a large amount of preliminary sales work has been accomplished in regions hitherto none too thoroughly canvassed, and the outlook is favorable for another good year.

Conduit Boxes Show Softer Prices by Boston Jobbers

A BETTER tone is manifest in electrical purchases, and nothing serious has been experienced in the way of reduced demand for staple products. Appliance sales are very active, and ordering against the forthcoming holiday trade is a feature of the jobbing field. Some anxiety as to

Comparative Prices of Station Supplies

	Current Price	Four Weeks Ago	One Year Ago
Soft steel bars, per lb.	$0.0354	$0.0354	$0.0304
Cold finished shafting, per lb.	0.0465	0.0465	0.039
Brass rods, per lb.	0.1525	0.1575	0.17
Solder (half and half), per lb.	0.295	0.295	0.265
Cotton waste, per lb.	10 to .13	10 to .13	.09 to .11½
Washers, cast iron (½-in.), per 100 lb.	6.50	6.50	6.00
Emery, disks, cloth, No. 1, 6-in. diameter, per 100	3.38	3.38	3.02
Machine oil, per gal.	0.297	0.297	0.33
Belting, leather, medium, off list	30-10%	30-10%	40-5%
Machine bolts, up to 1-in. x 30-in., off list	40-10%	40-10%	40%

December deliveries is being expressed in these lines. Prices are fairly firm this week, although softening in conduit boxes was anticipated Monday.

Stocks are meeting current needs in most lines, but poles are scarce and there is little prospect of an increased supply from local fields this fall. The kitchen lighting-unit campaign is sweeping New England in record-breaking style. General business is responsive to a better feeling throughout the country, barring slow recovery in cotton textiles. Central-station companies are very busy on line extensions owing to favorable weather, and interior wiring supplies are moving in fair volume without spectacular features.

Chicago Electrical Trade Steady but Uneventful

CHICAGO electrical jobbers and manufacturers report steadiness in demand for all general lines, with no advances or declines in prices and stocks in fair shape for the heavy holiday buying which will take place in the next few weeks.

Conduit sales have increased slightly, and rubber-covered wire sales have improved considerably. Pole-line hardware sales are much better than a month ago, owing to the heavy buying for replacements by the utilities. Appliance manufacturers report gratifying success from these advertising campaigns and believe that their present sales will total the largest in their experience.

Public Utilities Heavy Buyers in St. Louis Territory

BUSINESS in St. Louis during the past thirty days indicates an unsettled condition. In a number of electrical lines slight gains over the corresponding period last year are reported, but a recession in volume of trade in goods based on iron and steel is reported. Manufacturers and jobbers report that sales are numerous but not large. There is steady buying on the part of public utilities. Active demand for radio equipment and for household appliances continues. Initial buying of holiday goods is responsible for an increase in sales over the corresponding period last year. Stocks are fair and prices in general are firm, but there has been a slight reduction in the prices of copper, wire and pole-line hardware.

Atlanta Jobbers Report Satisfactory Business in Most Lines

JOBBERS report most satisfactory business in practically all lines, particularly heating devices. One of the largest jobbers states that his fall stocks of this line were 50 per cent in excess of those of last year, and, owing to the unusually active demand, these stocks are almost exhausted and it has been necessary to place large additional orders to handle the anticipated holiday trade. Heavy sales of pole-line hardware and a satisfactory movement of poles are reported, with considerable pick-up in the sales of lighting fixtures. One jobber reports a five-point price reduction on all types of transformers, effective Nov. 1.

After being somewhat slow for six weeks, the retail electrical business has improved considerably, and retailers have begun to place orders on the jobbers for holiday stocks. All the electrical interests in Atlanta are planning a very intensive co-operative pre-holiday advertising campaign, and the prospects are that the business this season will set a record in this section.

Excellent Volume and Improved Collections Along Pacific Coast

AN EXCELLENT volume of business is reported from the Pacific Coast with improved collections. Prices on most wiring staples have now become fairly steady and changes on individual articles in the wiring-device lines are nearly all minor adjustments. There is a general feeling that, after its long slump, copper is going to rise and several large wire orders are reported that have been placed with the idea of anticipating an increase in prices.

Porcelain used in house wiring is moving well with evidences of a keen price competition of business manufacturers. The appliance business continues to build up toward the Christmas market. An activity in Christmas-tree lighting outfits is already showing, although the demand will naturally not reach its peak until December.

The Pacific Coast continues to receive substantial orders from the Japanese for lumber and other materials. Out of this has come a considerable demand from industries affected for electrical materials.

The Metal Market

DURING the week copper has improved in price to 12.62½ cents, lead has declined slightly, and zinc has not shown much activity in either direction. On the whole, a better feeling is noticeable among the producers, but the situation in the copper and zinc markets remains unsatisfactory.

The official contract price of lead by the American Smelting & Refining Company has been reduced to 6.75 cents a pound, New York. Sales had been light at the former level, and the reduction was made to stimulate buying. Sales of lead have been a little heavier in volume than last week, but the market has been quiet.

The market for slab zinc has been inactive. Prices have ranged between 6.30 cents and 6.35 cents a pound, East St. Louis, during the week. A small number of export sales have been made.

NEW YORK METAL MARKET PRICES

	Oct. 31, 1923 Cents per Pound	Nov. 7, 1923 Cents per Pound
Copper, electrolytic	12.50	12.62½
Lead, Am. S. & R. price	6.75	6.75
Antimony	8.27½	8.50
Nickel, ingot	27.00 to 32.00	27.00 to 32.00
Zinc, spot	6.67½	6.35
Tin, Straits	42.12	42.02
Aluminum, 98 to 99 per cent	25.00	25.00 to 26.00

Activities of the Trade

Devoted to News of the Manufacturer, Jobber, Agent, Contractor and Dealer, Including Important Orders and Contracts for Apparatus and Equipment

Century to Manufacture Larger Sizes of Induction Motors

The Century Electric Company, St. Louis, announces that it is now manufacturing three-phase squirrel-cage induction motors up to and including 15 hp. This will add three more sizes to its list of this type of motor, viz., 7½, 10 and 15 hp. The company has been manufacturing three-phase squirrel-cage induction motors in small sizes for a number of years, and the demand for larger sizes has become so insistent that officials have decided to expand their squirrel-cage-motor line in this manner.

Alberger Condenser Contract

The contract for the new condenser to be added to the Logansport (Ind.) electric light plant has been awarded to the Alberger Condenser Company, Chicago, by the Board of Public Works of Logansport. The contract price, $26,326, calls for the purchase of the new condenser, connecting up and packing the new piece and also the repair of the present condenser in the plant. The new machine will cover a floor space of 5,100 sq.ft.

Radio Not Making Any Progress Against Cable, Says Carlton

Newcomb Carlton, president of the Western Union Telegraph Company, sailing on the *Mauretania* last week for a six weeks' trip abroad, said: "Western Union earnings for the nine months of the year have been very satisfactory. Our business has been running neck and neck with last year, but it is really 10 per cent less than it should be. Dividend prospects have not been discussed and will not be until later in the year. Radio is not making any progress against the cable, but, of course, it must be granted that the radio is now entering the best season of the year.

"We have not begun the manufacture of the Italian cable to the Azores, owing to British interference. I have been working on this matter for over a year, and eventually we will

win out through the aid of the State Department at Washington. The Western Cable Company of Great Britain, which holds the concessions in the Azores, wants a tribute or royalty from all American cable companies landing on the islands."

American Brass Cuts Prices

The American Brass Company has reduced quotations for its products, bringing them down to the basis of 12.50 cents to 12.62½ cents a pound for copper metal. Seamless tubes of all sizes have been cut 1 cent a pound, copper and brass products ½ cent, and copper-wire products ¼ cent per pound. Similar reductions were made on Oct. 8 last.

Two Dallas Jobbers Combine as Electric Appliance Company

Among the important recent mergers is that of the Electric Appliance Company and the Electric Specialty Company, both jobbers of Dallas, Tex., which will be conducted under the name of the Electric Appliance Company with the following officers: M. E. Martin, president; Charles L. Martin, secretary and general manager; M. F. Sterret, assistant to the president, and Harry Greer, sales manager.

All of these men have been identified with the electrical jobbing business in Dallas, and with the combining of forces and added financial strength a greatly increased volume of business is expected. It is reported that W. W. Low and Thomas I. Stacey of Chicago still hold a substantial interest in the company.

Stetson & Sloane Correction

The recent announcement published on this page concerning the organization of the firm of Stetson & Sloane as engineers and contractors, with offices at 60 State Street, Boston, to engage in the development of group and community electric light, water and sewage disposal systems, and particularly to engage in rural electrification, was incorrect as the name "Stetson" was spelled "Stepson" and the address "60 State Street" was given as "3061 State Street."

Sweeping Changes in General Electric Sales Organization

Lighting and Power and Mining Departments Are Renamed Central-Station and Industrial Departments—Transfers Affecting Prominent Figures in the Personnel

IMPORTANT rearrangements of the present field of work within the sales branch of the General Electric Company, involving a change of name of two departments, have just been announced. As reported in the ELECTRICAL WORLD last week, Dana R. Bullen, for a number of years manager of the supply department, has been advanced to the position of assistant vice-president on the staff of the vice-presidents in charge of sales of general apparatus and supplies. In addition, what has hitherto been known as the lighting department becomes the central-station department and the name of the power and mining department is changed to the industrial department.

P. W. Stone, manager of the former lighting department, will continue as manager of the central-station department. M. O. Troy, formerly manager of the transformer sales department, is appointed executive assistant manager of the central-station department, with headquarters at Schenectady, and W. M. Stearns, formerly one of the assistant managers of the supply department, becomes assistant manager of the central-station department in charge of the street lighting, miscellaneous switchboard devices, holding company contracts and miscellaneous supply and order sections.

R. D. Mure, assistant manager of the former lighting department, becomes assistant manager of the central-station department in charge of apparatus sales. F. G. Vaughen, with the present staff, is transferred to the central-station department and continues in charge of the meter business of the company, retaining the title of sales manager meter department. Similarly, W. S. Clark and present staff, in charge of the company's wire and cable business, are transferred to the central-station department.

The railway supply section and present staff, conducting the company's business on railway motor and control parts, railway line material and rail bonds, are transferred from the supply department to the railway department, of which E. P. Waller is manager.

The industrial heating device, industrial control, mine locomotives and stationary motor repair parts, and "fabroil," "testoil" and "textolite" gears sections of the supply department are transferred to the industrial department, of which A. R. Bush, manager of the department under its former name of power and mining department, continues in charge.

N. R. Birge, one of the two former assistant managers of the supply department, is assigned to the staff of the president of the company. Mr. Birge will assist in supervision of associated manufacturing companies, being associated with D. C. Durland in this work.

All these changes became effective November 1.

Henry D. Sears Appoints J. W. Fay New England Representative

Henry D. Sears, 80 Boylston Street, Boston, general sales agent for "Weber" wiring devices, announces the appointment of John W. Fay as district representative in all the New England states except Connecticut and the metropolitan district. Mr. Fay has been a specialty salesman with the Malden (Mass.) Electric Company and succeeds Carl C. Smith, who recently resigned.

The Parry Battery & Electric Company, Provo, Utah, recently incorporated, is successor to the Parry Battery Company and was organized for the purpose of carrying on the business of manufacturing electrically propelled vehicles. Ernest B. Parry is president of the company.

The Western Electric Company has leased the former plant of the Continental Candy Company, Westside and Claremont Avenues, Jersey City, N. J., approximating 240,000 sq.ft. of floor area, and will remodel and equip the structure for a new branch plant for the manufacture of telephone switchboards and apparatus. It is expected to commence production in January, giving employment to about 750 operatives. The company will begin operations at once at its new works at 780 Frelinghuysen Avenue, Newark, N. J., recently leased, which has been improved and equipped to give employment to more than 700 persons. Bids are being asked for structural steel for the initial units of the new plant to be erected at Kearny, N. J., and erection will soon begin. The latter works will cost more than $15,000,000.

The American Electrical Switch Company, Minerva, Ohio, has been organized to take over the plant of the former Lewis Electrical Company and has purchased the equipment. Charles P. Wolfe is general manager of the new company.

The Dixie Club Jobbers, an association composed of the electrical jobbers in the Southeast, held a two-day meeting at the Tutwiler Hotel in Birmingham on Oct. 26 and 27. The president, Percy Stearns of the Interstate Electric Company, New Orleans, was in charge of the convention.

Landers, Frary & Clark, Inc., New Britain, Conn., manufacturers of electric heating and cooking equipment, has taken bids for the erection of a new six-story addition on Ellis Street, 65 ft. x 160 ft., and expects to lay foundations at an early date. The firm will be equipped for increased manufacture.

The Electric Storage Battery Company, Philadelphia, will commence the construction of a new one-and-two-story plant at Rising Sun Avenue and Adams Road, Crescentville district, to cost about $100,000, including equipment. A contract for the work has recently been awarded.

Foreign Trade Notes

HYDRO-ELECTRIC PLANT IN CONNECTION WITH CANAL IN ALSACE-LORRAINE, FRANCE.—A hydro-electric plant, which will develop about 100,000 hp., according to *Commerce Reports*, will be built between the towns of Rosenau and Kembs, in connection with a canal which is to parallel the Rhine.

CONCESSION GRANTED FOR HYDRO-ELECTRIC DEVELOPMENT IN MOROCCO.—Approval has been given, *Commerce Reports* states, for a concession to a group of financial interests to generate and distribute electricity in Morocco. The project includes the construction of a group of plants, aggregating 15,000 kw. to 20,000 kw. capacity, situated in the upper basin of the Oumer-Rebia and its tributaries. The names of this group may be obtained from the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., or any of the bureau's district or co-operative offices, by referring to file No. 106,360.

PROPOSED TRANSMISSION OF ELECTRICITY FROM NORWAY TO DENMARK.—Three plans have been prepared by the committee appointed by the Danish, Norwegian and Swedish Power Transmission Commission for the transmission of electricity from Norway to Denmark. The first plan provides for the transmission of electricity by means of cables from southern Norway through Skagerrak to Jutland, thence by overhead conductors to Aarhus, and through the Little and Great Belts to Zealand and Copenhagen, where the energy will be transformed to alternating current. The water falls of Kviken and Otra, near the Norwegian south coast, will be utilized for generating electricity. Under the second plan it is proposed to transmit electricity through Sweden as far as Helsingborg through the sound, and then through Denmark. A large power station is being erected near the Nore Cataract, from which energy will be obtained. The third plan calls for another overhead transmission line through Sweden.

Foreign Trade Opportunities

Following are listed opportunities to enter foreign markets. Where the item is numbered, further information can be obtained from the Bureau of Foreign and Domestic Commerce, Washington, by mentioning the number.

An agency is desired in Shanghai, China (No. 8,050), for an arc-welding machine, alternating current.

An agency is desired in The Hague, Netherlands (No. 8,059), for electrical equipment.

An agency is desired in Algiers, Algeria (No. 8,060), for electrical goods and supplies.

CONCESSIONS GRANTED FOR ELECTRIC PLANTS IN ARGENTINA.—Four concessions have been granted by the Province of Cordoba, Argentina, since July 1, according to *Commerce Reports*, for the establishment of electric lighting plants. The names of the concessionnaires and the towns to be supplied with electricity can be obtained from the Electrical Equipment Division, Bureau of Foreign and Domestic Commerce, Washington, D. C., or from any of the bureau's district offices, by referring to file No. 109,537.

PROPOSED ELECTRIC PLANT AT SAO PAULO, BRAZIL.—Permission has been granted by the State of São Paulo, Brazil, to the Sociedad Anonyma Brasital, *Commerce Reports* states, to install a hydro-electric plant at Santo do Itú, São Paulo. The power will be used in its textile plant.

New Apparatus and Publications

VACUUM PUMPS.—A new line of small vertical belt-driven vacuum pumps, known as type 15, has been developed by the Ingersoll-Rand Drill Company, 11 Broadway, New York City.

FARM ELECTRIC PLANT.—The Independent Light & Power Company, Oelwein, Iowa, has placed on the market a new farm electric plant, known as model "T."

INDUCTION MOTORS AND STARTERS.—The Metropolitan-Vickers Electrical Company, Ltd., Tratfford Park, Manchester, England, is distributing leaflets Nos. 39/1-1, 59/4-1, 59/5-1 and circular No. 1059/1. The first describes its standard squirrel-cage induction motors, the second and third two types of auto-transformer and star-delta starters, and the circular its automatic oil-break ironclad switchgear.

ELECTRIC REFRIGERATOR. — The National Electric Products Corporation, 500 North Dearborn Street, Chicago, has brought out the "Serv-El" refrigerator, which is available in two styles, one with the machine unit in the lower section, and the other consisting of the machine only, which can be installed in any good refrigerator.

ELECTRIC GRINDER.—A new electric grinder, known as No. 102, has been placed on the market by Forbes & Myers, 172 Union Street, Worcester, Mass.

ELECTRIC WATER HEATER. — The National Water Heater Corporation, represented by Marshall & Company, 509 Fifth Avenue, New York City, has developed a water heater which is to be installed in place of an ordinary faucet. It is not a lamp-socket device, but is to be permanently installed by special wiring direct from the meter to the heater.

WALL BRACKET. — A wall bracket which may be regulated to give five different degrees of light has been placed on the market by W. A. Harvey, 53 Burr Building, Scranton, Pa.

COMMERCIAL LIGHTING UNIT.—The Peerless Light Company, 663 West Washington Boulevard, Chicago, has added a commercial lighting unit to its "Peerlites" line of lighting fixtures. The company has also brought out a complete line of Chippendale fixture parts.

ELECTRIC MOTORS. — The Wagner Electric Corporation, St. Louis, is distributing bulletin No. 134, describing its new type of constant-speed, alternating-current motor, which is known as the "Fynn-Weichsel" motor.

INSULATING MATERIAL.—The Thermal Syndicate, Ltd., 350 Madison Avenue, New York City, is distributing a booklet entitled "Vitreosil Data," giving the characteristics of its product, which is manufactured and marketed under the trade name of "Vitreosil," and also its use in connection with the electrical industry.

UNDERFEED STOKER.—The Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa., is distributing a booklet which describes and illustrates the Westinghouse new-model underfeed stoker.

CLEANING TOOL.—A tool, "Goodnite" for cleaning commutator slots on undercut commutators has been placed on the market by the Martindale Electric Company, 11,737 Detroit Avenue, Cleveland.

CHARGING UNIT FOR STORAGE BATTERY.—A resistor unit for charging automobile storage batteries has been developed by the Ward Leonard Electric Company, Mount Vernon, N. Y.

SAFETY SWITCH.—The Domestic Electric Company, 7222 St. Clair Avenue, Cleveland, has placed on the market an automatic safety switch for use with electric washers.

ELECTRIC LOG HEATER.—The Hersh Electric Specialty Company, 850 Twenty-second Street, Milwaukee, has brought out an electric fireplace log heater.

New Incorporations

THE RIPLEY (MISS.) LIGHT COMPANY has been incorporated with a capital stock of $10,000 by A. C. Anderson, C. T. Nelms and others.

THE NEW HAMPSHIRE POWER COMPANY, Newport, N. H., has been chartered by Roger F. Hooper, Franklin King and William Hill, all of Boston. The capital stock of the company consists of $55,000 in preferred shares of $100 each (par value) and 6,000 shares of common stock without par value.

THE TUSTEN LIGHT & POWER COMPANY, INC., Narrowsburg, N. Y., has been incorporated with a capital stock of $35,000, to supply electricity for light, heat and power. The directors are: R. H. Huebner, M. Huebner, both of Narroswburg, and W. J. Steinberger, Sussex, N. J.

THE CORNING (MO.) ELECTRIC LIGHT COMPANY has been incorporated to install and operate a commercial system in Corning. P. A. Christian and R. E. Schultz, both of Corning, are among the incorporators.

Construction News

Projects, Plans, Bids and Contracts, Contemplated or Under Way

New England States

AUBURN, ME.—Plans for the proposed brick manufacturing plant to be established in the Danville Junction section, to cost about $200,000, include a power house. H. B. Richie, Aroostook, is interested.

AUGUSTA, ME.—The stockholders of the Central Maine Power Company have voted to increase the capital stock of the company by $9,500,000, subject to the approval of the Public Service Commission.

EAST DORSET, VT.—The Manchester Marble Company plans to install electric power equipment in connection with the rebuilding of its Friedley plant, recently destroyed by fire with loss of about $100,000.

MORRISVILLE, VT.—The Village Council is considering a hydro-electric development, to cost about $150,000. C. A. Slayton is superintendent of the municipal electric plant.

ALLSTON, MASS.—Plans for the proposed local plant for assembling motors to be erected by the International Harvester Company, 606 South Michigan Avenue, Chicago, include a power house. The cost is estimated at $1,000,000.

BETHEL, CONN.—Electric power equipment will be installed in the proposed local plant to be established by the Specification Brush Company, 121 West Seventeenth Street, New York.

Middle Atlantic States

BUFFALO, N. Y.—Electric power equipment will be installed in the new local plant of the Bemis Brothers Bag Company, St. Louis, Mo., comprising the former works of the Kelly-Springfield Tire Company, 711 Northland Avenue.

DEFERIET, N. Y.—The St. Regis Paper Company, Watertown, plans to build a power house at its proposed local pulp and paper mill, to cost about $500,000.

DUNKIRK, N. Y.—Electric power equipment will be installed at the plant of the Atlas Steel Corporation, in connection with extensions and improvements to cost about $400,000.

HIGH FALLS, N. Y.—The International Paper Company, 100 East Forty-second Street, New York, plans to build a hydro-electric power plant on the Saranac River, to cost about $500,000.

POTSDAM, N. Y.—The installation of electric pumping machinery at the proposed new waterworks, to cost about $175,000, is under consideration. Bogart & Pohl, 30 Church Street, New York, are consulting engineers.

CANTON, PA.—The North Penn Power Company has acquired the properties of the Canton (Pa.) Illuminating Company and the Troy (Pa.) Electric Light & Power Company. The systems will be merged and extensions and improvements made.

CHEAT HAVEN, PA.—The West Penn Power Company, Pittsburgh, is planning to build a large hydro-electric plant at Cheat Haven.

HARRISBURG, PA. — The Harrisburg Light & Power Company will issue bonds for $275,000, part of the proceeds to be used for extensions and improvements.

MEADVILLE, PA.—The Venango Public Service Company has acquired the property of the Northwestern Electric Service Company and plans extensions and improvements to the system.

PHILADELPHIA, PA.—Electric traveling cranes and other electrical equipment will be installed by the Philadelphia & Reading Railroad Company at its new piers in the Port Richmond section, to cost about $1,500,000.

PHILADELPHIA, PA. — The American Ice Company, City Central Building, will install electric power equipment at its proposed ice-manufacturing plant, to cost about $350,000.

YORK, PA.—The American Chain Company, Bridgeport, Conn., will install electric power equipment at the proposed addition to its local plant, to cost about $500,000.

BALTIMORE, MD.—Electric power equipment will be installed in the new plant of the Industrial Chemical Company, 110 East Forty-second Street, New York, in the Fairfield section, now under construction, to cost about $1,000,000.

BALTIMORE, MD. — Electric power equipment will be installed in the printing plant to be erected by the Baltimore *American*, at Commerce and Pratt Streets, to cost about $500,000. George R. Callis, Jr., American Building, is architect.

DUNBAR, W. VA.—Plans are being considered for the installation of electric pumping machinery at the proposed new waterworks plant.

HINTON, W. VA.—The West Virginia Power Company has been granted permission by the Federal Power Commission for preliminary work, to cost about $150,000 in connection with a hydro-electric project on the New River, near the mouth of the Bluestone River.

FARMVILLE, VA.—Bonds to the amount of $50,000 have been voted for improvements to the municipal electric plant.

NORFOLK, VA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 30 for conduit and wiring changes, lighting fixtures, etc., in the United States post office and court house, Norfolk. For details see Searchlight Section.

YORKTOWN, VA.—Bids will be received by the Bureau of Accounts and Supplies, Navy Department, Washington, D. C., until Nov. 27, for 2,500 battery holders, for the local navy mine depot. (Schedule 1541).

WASHINGTON, D. C.—A power house will be erected at the Garfield Memorial Hospital in connection with a new building at Tenth Street and Florida Avenue, to cost about $250,000. Col. P. M. Anderson, Southern Building, is engineer.

WASHINGTON, D. C.—Bids will be received by the Bureau of Supplies and Accounts, Navy Department, until Nov. 27 for electrical supplies for Eastern and Western yards (Schedules 1530 and 1540); for dry cells and batteries (Schedule 1528); fuses and fuse elements (Schedule 1529) for Eastern and Western yards, and for flashlights (Schedule 1532).

WASHINGTON, D. C.—Bids will be received by the chief of air service, United States Army, until Nov. 12 for two ammeters and two voltmeters (Circular Q.R. 24-51); 200 connector-panel assemblies, and 200 switch-panel assemblies (Circular CAS 24-47).

WASHINGTON, D. C.—Bids will be received by the general purchasing officer, Panama Canal, until Nov. 19 for four motors, 25,000 ft. telephone wire, 10,000 ft. rubber insulated wire, 434 lb. magnet wire, 500 lb. cotton-covered wire and 10,000 ft. single-conductor wire (Circular 1569); also, until Nov. 22 for 100 switchboard cords and miscellaneous electrical and mechanical appliances (Schedule 1570).

North Central States

DETROIT, MICH.—Electric power equipment will be installed in the new plant to be erected by the Detroit Concrete Receptacle Company, 4225-27 Michigan Avenue, in the Woodward Heights section, to cost $250,000.

LANSING, MICH.—Extensions and improvements, involving an expenditure of about $1,200,000, are contemplated by the Michigan State Telephone Company in connection with its merger with the Citizens' Telephone Company.

PALMER, MICH.—The Michigan Gas & Electric Company has contracted to furnish service for the local Isabella Mine of the Youngstown Sheet & Tube Company, the initial load to approximate 400 hp.

PETOSKEY, MICH.—The Petoskey Portland Cement Company is planning to construct a new power plant at its mill.

CLEVELAND, OHIO.—The City Council is considering an issue of $400,000 in bonds for the installation of additional street lamps and distribution service for same.

MARION, OHIO.—Steps have been taken by property owners for the installation of ornamental lamps on First Street between Main and Jefferson Streets.

TIFFIN, OHIO.—Electric power equipment will be installed in the proposed plant addition to be erected by the Standard Sanitary Manufacturing Company, Bessemer Building, Pittsburgh, to cost about $350,000. G. W. Netcher, Tiffin, is architect.

TOLEDO, OHIO.—The City Council has authorized the installation of fifty-seven electric lamps to be installed in the Wildwood, recently annexed to the city.

INDIANAPOLIS, IND.—The Indianapolis Light & Heat Company has acquired a tract of land near the city on which it proposes to erect a superpower generating station within the next two years.

INDIANAPOLIS, IND.—The Indianapolis Lighting & Heating Company will erect a new building, 30 ft. x 200 ft., at Fortieth and Northwestern Streets, for general operating service.

JEFFERSONVILLE, IND.—The Interstate Public Service Corporation has been granted permission to issue $126,000 in bonds and $75,000 in capital stock, the proceeds to be used for the purchase of the property of the Jeffersonville Water, Light & Power Company, and for extensions.

GRANVILLE, WIS. — Preliminary arrangements are being made by the Milwaukee (Wis.) Electric Railway & Light Company to erect an electric plant in Granville.

GREENBAY, WIS.—The Wisconsin Public Service Corporation has completed the installation of the 60-cycle generators (replacing the 25-cycle generators) in its High Falls hydro-electric plant. Plans are now under way by the company to install 60-cycle equipment in its two hydro-electric plants on the Peshtigo River and also its steam auxiliary steam generating plant at Manitowoc, to replace the 25-cycle equipment.

PULASKI, WIS.—Plans have been completed by the Badger Utility Company for extending its transmission lines into new territory. The company purchases energy from the Wisconsin Traction, Light, Heat & Power Company, Appleton.

WAUKESHA, WIS. — Plans have been prepared by the Waukesha Gas & Electric Company and the Wisconsin Telephone Company for placing their wires underground in the downtown section of the city.

WEST BEND, WIS. — The Atlantic & Pacific Milk Products Company contemplate building a power house in connection with proposed additions to its plant.

WISCONSIN RAPIDS, WIS.—The Pigeon River Lumber Company has received a three-year permit from the Federal Power Commission for its hydro-electric project on the Pigeon River, consisting of five dams and five power houses.

LESUEUR, MINN.—The Minnesota Valley Canning Company contemplates erecting a power house at its factory, to cost about $50,000. R. W. Richardson, Zenith Building, St. Paul, is engineer.

CLARINDA, IOWA.—The Lee Electric Company will soon purchase two new boilers for its local plant.

HAMBURG, IOWA.—The Iowa, Service Company will soon rebuild its transmission line from Hamburg to Riverton, a distance of 10 miles.

SIOUX CITY, IOWA. — Extensions are contemplated to the ornamental lighting system, consisting of 200 electroliers, to cost about $20,000.

SPRINGFIELD, MO. — Electric power equipment will be installed in the proposed new plant of the Inland Printing & Binding Company, to replace its factory recently destroyed by fire, with loss of about $200,000.

WEST POINT, NEB.—The City Council contemplates purchasing electricity from the Nebraska Gas & Electric Company, Norfolk, to operate the municipal electric system. The company plans to erect a line at once.

KANSAS CITY, KAN. — Bonds to the amount of $4,100,000 have been authorized by the voters, of which $2,000,000 will be used for extensions to the Municipal Electric Light Department, $2,000,000 for the Water Department and $100,000 for the Fire Department.

MARQUETTE, KAN. — Plans are being prepared for rebuilding the municipal electric distributing system.

Southern States

NORTH WILKESBORO, N. C. — The municipal electric plant was recently damaged by fire.

ROANOKE RAPIDS, N. C.—The Roanoke Rapids Power Company has awarded a contract to Stone & Webster, Inc., 147 Milk Street, Boston, engineer, for the construction of an addition to its hydro-electric power plant, including alterations and improvements in present station and waterway.

ROCKY MOUNT, N. C.—Extensions to the municipal electric light plant are under consideration.

GREENVILLE, S. C.—Arrangements are being made to erect a new power house at the Teachers' Training College at Greenville, to cost about $125,000.

SPARTANBURG, S. C.—The Manufacturers' Power Company plans to install a local light and power system for commercial service.

ATLANTA, GA.—Electric power equipment will be installed in the proposed plant of the Nelstone Company of Georgia, Inc., 509 Candler Building, to cost about $100,000. R. L. Langston is manager and engineer.

SAVANNAH, GA.—Bids will be received at the office of the supervising architect, Treasury Department, Washington, D. C., until Nov. 28, for furnishing and installing lighting fixtures in the United States marine hospital at Savannah. For details see Searchlight Section.

JEFFERSON CITY, TENN.—The Tennessee Electric Power Company, Chattanooga, has purchased the local electric plant. The company has also been granted a franchise in White Plain.

MEMPHIS, TENN.—The Blair Construction Company plans to install a lighting system on a tract of property to be developed in the Parkway Place section, including street lamps, and commercial system.

NASHVILLE, TENN.—Plans are under consideration for extensions to the municipal waterworks, to include a power house. The J. N. Chester Engineers, Pittsburgh, Pa., is engineer.

SHELBYVILLE, TENN.—Plans are under way by the Public Light & Power Company to build a dam and power house to develop 750 hp., at a cost of about $75,000. L. W. Hope is engineer in charge.

BIRMINGHAM, ALA. — Electric power equipment will be installed in the proposed local ice-manufacturing plant, to cost about $100,000, to be constructed by Henry L. Sherrod, Gadsden, and associates.

RUSSELLVILLE, ALA. — The Alabama Power Company has acquired the local municipal power plant.

JACKSON, MISS.—The Enochs Lumber Manufacturing Company contemplates rebuilding its power house and plant, recently damaged by fire, with loss of about $450,000.

BLYTHEVILLE, ARK.—The Arkansas-Missouri Power Company contemplates extensions and improvements, to cost about $274,000.

EUREKA SPRINGS, ARK.—The Carroll County Utilities Company has applied for a franchise in Berryville and plans to erect a high-tension transmission line through that city and other places to Harrison with power plants at both ends of the line.

ERATH, LA.—The installation of a municipal electric ssytem, to cost about $12,000, is under consideration.

LAWTON, OKLA. — The Southwestern Light & Power Company plans to erect a 66,000-volt transmission line to Quanah, about 105 miles. A branch line will be erected to Snyder.

DALLAS, TEX.—The North Texas Trust Company, Mercantile Bank Building, is planning to install an electric lighting system on property to be developed in the northwestern section of Oak Cliff.

GRAND SALINE, TEX.—The installation of electrically operated pumps in connection with a new waterworks system, to cost about $80,000, is under consideration. H. N. Roberts, 422 Irving Place, Dallas, is engineer.

GRAND SALINE, TEX.—The American Public Service Company has acquired the properties of the Grand Saline Light & Power Company, and also the systems at Quitman, Gilmer, Big Sandy, Alba and vicinity, and will make extensions and improvements.

HOUSTON, TEX.—Plans are being arranged for the installation of electrically operated pumping machinery in connection with extensions to waterworks plant, to cost about $500,000.

HOUSTON, TEX.—The City Council is considering the question of requiring the electric light and street-railway companies to place their wires underground on Washington Avenue between Tenth and Fifth Streets.

JACKSONVILLE, TEX.—The Jacksonville Electric & Ice Company has acquired the properties of the Rusk (Tex.) Light & Power Company and the Troupe (Tex.)

Light & Power Company and will make extensions. A transmission line will be erected to Rush, Troupe and vicinity.

Pacific and Mountain States

PORT TOWNSEND, WASH.—The Washington Coast Utilities Company plans extensions and improvements to its local system, to cost about $22,000.

TACOMA, WASH.—Bids are being received, to be opened about Dec. 1, for construction of the dam in connection with the Lake Cushman hydro-electric plant, to cost about $1,250,000. Bids for equipment will be asked for early in the year and for power house early next spring. J. L. Stannard, City Hall Annex, is engineer in charge. Ira S. Davisson is commissioner of the municipal electric plant.

CLAREMONT, CAL.—Electric power equipment will be installed in the proposed local plant of the American Crushed Rock Company, to cost about $150,000.

LOS ANGELES, CAL.—The Art Commission has approved plans for an ornamental lighting system on Sunset Boulevard, consisting of 750 lamps standards, to cost about $300,000.

MARYSVILLE, CAL.—Funds to the amount of $1,150,000 are available for development project at Bullard's Bar dam for the Yuba River Power Company. The work will include raising the dam to 175 ft., the construction of a hydro-electric plant to develop 6,500 hp. and erection of transmission lines to the Colgate power house of the Pacific Gas & Electric Company.

NATIONAL CITY, CAL.—Electric power equipment will be installed in the proposed local group of industrial buildings to be erected by the Spreckles Brothers Commercial Company, San Diego, to cost about $100,000.

REDLANDS, CAL.—Extensions and improvements to cost about $250,000 in the Redlands district are contemplated by the Southern California Edison Company. The work will include several large substations which are to be made intercommunicative with the Laguna Bell 220,000-volt station, where energy is received from the generating station in the Sierra Nevada Mountains.

SAN JOSE, CAL.—Plans are being prepared by the Pacific Gas & Electric Company, San Francisco, for a local warehouse and garage, to cost about $90,000.

SANTA MARIA, CAL.—Plans are being prepared by the City Trustees for the installation of an ornamental lighting system on Broadway and Main Street.

TAFT, CAL.—A special election will be held on Nov. 27 to vote on the proposition to issue $148,000 in bonds for the installation of an ornamental lighting system.

THREE RIVERS, CAL.—The San Joaquin Portland Cement Company plans to build a power plant in connection with its proposed local mill, to cost about $600,000.

TURLOCK, CAL.—The Turlock Irrigation District has approved an appropriation of $500,000 for the construction of a steel-tower electric transmission system, about 90 miles.

MISSOULA, MONT.—The City Council plans to install electrically operated pumping machinery in connection with extensions and improvements in the waterworks, to cost about $600,000.

DENVER, COL.—Plans will be prepared by A. E. and C. A. Millington, engineers, Denver, for a hydro-electric power plant to be constructed in the vicinity of Lake Orchard, Ketchikan, Alaska, with initial capacity of about 10,000 hp., to be used for service at a local paper and pulp mill, for which plans also are in progress.

Canada

JARVIS, ONT.—Plans are under consideration for the erection of a transmission line from here to Hagarsville (7 miles), to cost about $35,000. The work will be done under the direction of the Hydro-Electric Power Commission of Toronto.

TORONTO, ONT.—Extensions and improvements are contemplated to the Toronto Hydro-Electric System, involving an expenditure of about $1,940,000. E. M. Ashforth is manager.

THREE RIVERS, QUE.—The North Shore Power Company, Ltd., it is reported, will call for bids about Nov. 15 for the construction of a dam at Chute de la Cheminée, on the Bastican River, St. Geneviève Parish, to develop about 4,000 hp. The cost is estimated at about $500,000.

Electrical Patents

Announced by U. S. Patent Office

(Issued Oct. 16, 1923)

1,471,096. Electrical Apparatus; F. F. Brand, Pittsfield, Mass. App. filed May 8, 1919. Low-voltage transformer winding of tubular coils through which cooling liquid flows.

1,471,129. Recording Mechanism; D. S. Holt, Mittineague, Mass. App. filed Oct. 31, 1921. Pen-and-holder construction for graphic instruments.

1,471,132. Trolley-Wire Support; A. E. Anderson, Milton, Mass. App. filed June 29, 1923. Wire splicer.

1,471,135. Trolley; W. A. Bartlett, Baltimore, Md. App. filed March 1, 1923. Trolley contact wheel with several grooved rollers.

1,471,165. Radio Reception; L. L. Jones, New York, N. Y. App. filed July 19, 1920. Utilizes two antennas.

1,471,173. Terminal for Electric Conductor Wires; J. A. Kulier, Brooklyn, N. Y. App. filed March 24, 1920. Plug connection.

1,471,183. Shield for Electrical Apparatus; A. G. Miller, Philadelphia. App. filed May 22, 1920. X-ray apparatus.

1,471,196. Field Frame; A. B. Owen and T. Hall, of Ridgway, Pa. App. filed Jan. 24, 1917. Method of forming machine frames.

1,471,208. Multiple Lamp Socket; B. I. Rockoff and E. Rockoff, Chicago, Ill. App. filed June 26, 1919. Combined plug and lamp socket.

1,471,263. Electrical Apparatus; H. M. Hobart, Schenectady, N. Y. App. filed Aug. 28, 1919. Cooling transformers by water system where water evaporates.

1,471,319. Radio-Telegraph Signaling System; H. Pratt, San Francisco, H. F. Elliott, Palo Alto, and U. B. Murphy, Burlingame, Cal. App. filed Jan. 3, 1921. Audio-frequency waves radiated from antenna system to which an undamped wave arc generator is connected.

(Issued Oct. 23, 1923)

1,471,326. Welding Electrode; J. P. Copland, Hudson, Ohio. App. filed Nov. 12, 1921. Contains chromium and tungsten.

1,471,329. Surgical Baker; W. S. Edmands, Boston, Mass. App. filed Jan. 28, 1922. For heat treatment of human body.

1,471,335. Signaling System and Method of Operating the Same; E. D. Johnson, East Orange, N. J. App. filed Jan. 24, 1918. Uses one-way telephone repeater for either direction.

1,471,340. Outlet or Junction Box; J. G. Knight, Brooklyn, N. Y. App. filed Sept. 15, 1921. Eight-sided box.

1,471,342. Means for Controlling Processes of Production; L. Logan, Arlington, Mass. App. filed April 30, 1920. Automatically controlling process by variations in radiant energy.

1,471,345. Electric Ignition System for Internal-Combustion Engines; J. L. Milton, Cleveland, Ohio. App. filed June 14, 1912.

1,471,357. Electrical Impulse Indicator; S. Ruben, New York, N. Y. App. filed March 15, 1922. Vacuum tube indicates impulses sharply at high speed.

1,471,383. Method of and Means for Measuring Unbalance; A. B. Clark, Brooklyn, N. Y. App. filed Oct. 15, 1919. For telephone line and its network.

1,471,388. Signaling Circuit; E. Dietze, Brooklyn, N. Y. App. filed Jan. 26, 1921. Telephone circuit having characteristics of Campbell type.

1,471,391. Rheostat; R. R. Dunlop, Columbus, Ohio. App. filed May 27, 1921. Grid resistances for railway motors.

1,471,404. Signaling Circuit; W. H. Martin, New York, N. Y. App. filed Jan. 26, 1921. Telephone circuit having characteristics of Campbell type.

1,471,406. Radiotelegraphy; F. S. McCullough, Cleveland, Ohio. App. filed July 25, 1919. Determining direction of distant transmitting stations.

1,471,418. Tuning Transformer; J. F. Rodgers, Brooklyn, N. Y. App. filed May 26, 1922. Variable inductance for wireless circuits.

1,471,423. Art of Treating Grain in Bulk by Electricity; F. S. Smith, Philadelphia, Pa. App. filed Feb. 12, 1919. For destroying any insect life.

1,471,432. Device for Testing Electric Circuits; G. W. Welford, Jr., Philadelphia, Pa. App. filed Nov. 12, 1921. For determining whether line is alive or dead.

1,471,455. Electric Door Opener; F. C. Ernst, New York, N. Y. App. filed Aug. 15, 1922. No spring used to return latch to locking position.

1,471,469. Method of Detinning Tin Scrap and the Like; E. Kardos, Newark, N. J. App. filed April 14, 1920. By immersing tin scrap in alkaline electrolyte.

1,471,486. Dry Cell; A. C. Jewett, New Haven, Conn. App. filed July 1, 1920. Method of holding depolarizing material together.

1,471,494. Electric Fixture Canopy; M. J. Lubow, New York, N. Y. App. filed Jan. 6, 1922. Lamp socket fastens directly to canopy.

1,471,545. Conductor Support; H. P. Chandler, Mansfield, Ohio. App. filed May 1, 1923. For securing trolley wire to overhead hanger.

1,471,546. Conductor Support; H. P. Chandler, Mansfield, Ohio. App. filed June 18, 1923. Trolley-wire clamp.

1,471,547. Production of Submarine Signals and the Location of Submarine Objects; C. Chiloswky and P. Langevin, Paris, France. App. filed May 19, 1917. By synchronous vibrating apparatus.

1,471,617. Telephone-Exchange System; A. E. Lundell, New York, N. Y. App. filed Sept. 8, 1917. Setting up of connection controlled by the calling subscriber.

1,471,632. Self-Induction Coils for Loading Telephone Cables; E. Schürer, Cologne-Mulheim, Germany. App. filed April 28, 1921.

1,471,636. Artificial Line; H. J. Vennes, New York, N. Y. App. filed Aug. 24, 1920. Carrier-current telephone system.

1,471,638. Telephone System; D. F. Whiting, New York, N. Y. App. filed Dec. 28, 1918. Amplifying means.

1,471,639. Telephone System; D. F. Whiting, New York, N. Y. App. filed July 22, 1919. Attenuation-equalizing means for voice-frequency range.

1,471,641. Electrolytic Gas Cell; C. F. Adams, Dayton, Ohio. App. filed March 9, 1922.

1,471,682—Portable Electric Lantern; C. B. Burnet, South Norfolk, Va. App filed June 25, 1920. Self-contained generator driven by spring motor.

1,471,696. Telephone; J. Kay, Stockport, and J. Jennings, London, England. App. filed March 22, 1921. Small inter-office telephone sets.

1,471,698. Reciprocating Electric Motor; G. Mazza, Turin, Italy. App. filed April 12, 1921. For percussive tools.

1,471,708. Electrical Apparatus for Indicating and Repeating Movements at a Distance; J. L. Routin, Paris, France. App. filed Feb. 25, 1920. Based on principle of Wheatstone bridge.

1,471,733. Theft Alarm; C. A. Isbell, Pasadena, Cal. App. filed Feb. 5, 1920. For automobiles.

1,471,739. Battery Holder; M. Kammerhoff, Orange, N. J. App. filed April 26, 1920. For flashlights.

1,471,756. Wave Signaling System; W. B. Schulte, Madison, Wis. App. filed Oct. 17, 1918. Relates to the plate-filament circuit of a wave-receiving system.

1,471,823. Electric Sadiron; W. C. Boswell, Baltimore, Md. App. filed June 14, 1922. Heating elements readily removed.

1,471,834. Electric Motor Terminal Connection; M. A. Defibaugh, Battle Creek, Mich. App. filed Aug. 24, 1921. For split-phase induction type motors.

1,471,849. Ammeter; F. W. Kaisling, Jr., Chicago, Ill. App. filed Oct. 25, 1919. For ignition and lighting circuits of automobiles.

1,471,851. Armature Winding; R. T. Kingsford, Philadelphia, Pa. App. filed May 15, 1920. For automobile storage-battery charging generator.

1,471,863. Electrical Change-Over Apparatus; H. Riegger, Berlin, Germany. App. filed Aug. 24, 1922. For submarine signaling purposes.

1,471,878. Electric Gong; G. H. Bickell, Brookline, Mass. App. filed Oct. 13, 1919. Operated by alternating current.

1,471,893. System and Apparatus for Power Transmission and Regenerative Braking; W. S. H. Hamilton and R. D. Knape, Schenectady, N. Y. App. filed Oct. 15, 1921.

1,471,897. Battery-Charging System; H. M. Jacobs, Schenectady, N. Y. App. filed April 6, 1921. Suitable for several voltages.

1,471,901. Synchronizing of Shafts; H. Lemp, Erie, Pa. App. filed Oct. 6, 1921. Method of driving several shafts at same speed.

1,471,907. Machine for Heading Porcelain Tubes and the Like; A. G. Mason and L. C. Buckley, Lisbon, Ohio. App. filed March 4, 1922. Automatic operation.